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HERBERTIA

III

VOLUMES 11-15

1944—1948, incl.

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

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NEW SERIES OF HERBERTIA

Volumes 1 to 15, inclusive, constitute the first series of HERBERTIA, and it should be noted that beginning with vol. 5, of PLANT LIFE, the annual year book devoted exclusively to the Amaryllids, HERBERTIA, will be published in a new series, but in the same format as heretofore, entitled HERBERTIA and devoted exclusively to the amaryllids, as heretofore, and will thus remain unchanged in all respects except that for reasons of convenience in handling publication details, it will appear as one of the annual numbers of PLANT LIFE.

As soon as possible, a complete INDEX VOLUME to vols. 1—15, incl., of the first series of HERBERTIA, will be issued. When this is ready for publication announcement will be made so that those interested may purchase copies.

[Note.—This leaf, page iii, is to be bound with the front title page, etc., for Vols. 6—10, incl., that were included at the end of **Herbertia**, vol. 10.]

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HERBERTIA



1944

HERBERTIA

VOLUME 11

ALLIEAE EDITION

EDITED BY

HAMILTON P. TRAUB

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford University P. O., Calif.

1944

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This volume contains a total of forty-three illustrations—twenty-five plates and eighteen [text] figures.

PREFACE

The ALLIEAE Edition, devoted primarily to the onion and its relatives as a worth while contribution to the war effort, is one of the most outstanding issues of HERBERTIA published up to the present, and this achievement is in very great measure due to the splendid cooperation of our British friends. Prof. E. J. Salisbury, C. B. E., F. R. S., Director of the Royal Botanic Gardens, Kew, authorized a talented member of his staff, Mr. H. K. Airy Shaw, B. A., F. L. S., to make the excellent translation, from the Russian into English, of Vvedensky's monumental monograph of the genus *Allium* in the Soviet Union, which is the main feature of this issue. The making of this translation was in itself also a monumental undertaking and Mr. Shaw is to be congratulated on the high quality of the finished product. The annotations by Messrs. Shaw and Stearn will serve a very useful purpose. At one stroke this work gives us descriptions of 225 *Allium* species, about 38 per cent of the estimated total of 600 species in the genus.

Mr. William T. Stearn, formerly of the Lindley Library, Royal Horticultural Society, but now in the British Army, has favored us with some valuable contributions, including an illuminating essay on the Alliums in the Old World; an article on the floristic regions of the Soviet Union, that serves as an introduction to the translation of Vvedensky's monograph; a translation of Victor de Janka's "Key to the Alliums of Europe", and a very thorough research on the "Nomenclature and Synonymy of *Allium odorum* and *A. tuberosum*". These contributions are of the very highest order and will serve as a sound basis for further progress.

In behalf of the members of the Society, the writer takes this opportunity of putting on record expressions of gratitude to Prof. Salisbury, Mr. H. K. Airy Shaw, Mr. Cotton, and others at Kew, and Mr. Stream, formerly of the Royal Horticultural Society, and now with the British Army, who have cooperated so generously. Last, but not least, a debt of gratitude is due the unofficial ambassador of good will, of whom Britain is justly proud, our good and well known friend, Major Albert Pam, O. B. E., V. M. H., F. L. S., who arranged the details of the cooperation and personally saw to it that the articles reached us in time for publication in this issue. Due to this generous cooperation, the systematics of the genus *Allium*, to which the domestic onion belongs, is at last receiving the attention it deserves.

In this connection it is of interest to note that on November 25 the University of Oxford conferred the degree of M. A., *honoris causa*, on Major Pam. The writer is certain that the members will join him in extending to Major Pam heart-felt congratulations.

The ALLIEAE EDITION of HERBERTIA is fittingly dedicated to Dr. Henry A. Jones, Principal Olericulturist at the U. S. Dept. of Agri. Bureau of Plant Industry Station, Beltsville, Maryland, the eminent American authority on the onion, who contributes a brief autobiography and an important article on onion breeding. Articles on onion propaga-

tion by Drs. Little, Jones and Clarke; on nutrient deficiency effects in the onion by Dr. Stuart and Miss Griffin, and colchicine-induced tetraploids in *Allium* by Miss Toole and Dr. Clarke, are contributed by Dr. Jones and his associates at Beltsville, Maryland. The gratitude of the Society is due to these workers for these first rate contributions. The members interested in amaryllid breeding will be particularly interested in the article on colchicine-induced tetraploidy since it clearly outlines a technique that has application to other amaryllids. It should be noted that proper caution is to be exercised in handling the poison, colchicine.

Dr. Uphof favors us with a review of "Little Known Allieae of Northwestern North America." Sgt. Harkness, the Chairman of the Allieae Committee, has arranged what is apparently the first symposium on ornamental Alliums in North America, including contributions by Mrs. Helen M. Fox, Miss Elizabeth Lawrence, Mrs. Lester Rowntree, and Messrs. F. L. Skinner and Claude A. Barr. The thanks of the Society go to Dr. Uphof and Sgt. Harkness wherever he is now serving his country in the U. S. Army.

Grateful acknowledgement is also due for various articles on other amaryllids. Dr. Du Puis and Messrs. Zeiner, Brown and James write about hybrid Amaryllis. Articles on daylilies are furnished by Professors Watkins and Saxton; Messrs. Claar, Gilmer, Shull; Miss Christenson, and Drs. Cooley and Stout. Various amaryllids are discussed by Miss Stanford, of South Africa, Miss Stewart, of Texas, and Messrs. James, Hannibal and Houdyshel.

The next issue of *Herbertia*, 1945, will be dedicated to Supt. R. G. Huey of the Paintsville (Kentucky) Public Schools, for his pioneer contributions toward the use of amaryllids as an educational tool. (The readers are directed to the brief notes by Supt. Huey and Mr. Nelson in the present issue.) The 1945 issue will also contain a wealth of material on hybrid *Amaryllis*, daylilies, *Narcissus*, Alliums, and other amaryllids. Many of these contributions have already been received and it is hoped that the issue can be mailed out earlier than was possible in case of the past few numbers.

Herbertia for 1946 will be the NARCISSUS EDITION, and the very active and competent Narcissus Committee promises an outstanding coverage of the *Narcissus* field for this issue. The other amaryllids, as usual, will receive due attention.

December 22, 1944.
Salinas, California.

—Hamilton P. Traub

(PREFACE—Continued on page 9.)

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ERRATA

HERBERTIA, VOL. 10, 1943

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NOTE FOR HERBERTIA CONTRIBUTORS

Correspondence regarding articles and illustrations for HERBERTIA, the Year Book of the American Amaryllis Society, is cordially invited.

STYLE. Manuscripts must be *typewritten* and *double-spaced*. Check with special care all calculations, figures, tables, names, quotations and literature citations.

MANUSCRIPTS AND PHOTOGRAPHS. To insure against loss in the mails, authors should *retain copies* of manuscripts, and the *original negative or extra prints* of photographs, sent for publication in HERBERTIA. Photographs should have the *name and address* of the owner to whom credit should be given, and the *name and size of the subject*, written on the back.

When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves*, *scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

(PREFACE—Continued from page 4.)

The majority of the linotype operators at our printer's are serving in the U. S. Armed Forces and that accounts for the late appearance of this Volume of HERBERTIA. However, it is hoped that the members will feel that the rich harvest contained in this volume is worth waiting for.

In the meantime, our Executive Secretary, L. S. Hannibal, has resigned. The gratitude of the members is due to Mr. Hannibal for his unselfish devotion to the Society's interests during his term in office. Mr. E. Frederick Smith, Assistant Instructor in Biological Sciences at Stanford University, California, has accepted the position of Assistant Secretary, in charge of the membership roster, etc. Mr. Smith is a U. S. Navy veteran of World War I; he received his education in horticulture at Iowa State College, Ames; and he has had wide experience with plants. He was formerly employed by the Berkeley (Calif.) City Park Board; later he engaged in private nursery and landscape business; and recently, before going to Stanford University, he was employed in the U. S. Guayule Rubber Research Project in California. The Society is fortunate to secure the services of Mr. Smith.

In the meantime, also, the field of the Society has been enlarged to include all of plant life, and the name of the organization has been changed to the American Plant Life Society. HERBERTIA, the year book devoted to the amaryllids, as well as all the other activities concerned with the amaryllids, will be continued, and in addition, for the present, occasional numbers of PLANT LIFE, devoted to plant life in general, will be published and sent to all members.

September 17, 1945

Hamilton P. Traub
Editor

NOTE TO MEMBERS AND LIBRARIANS

The ERRATA list for HERBERTIA, Volume 10, 1943, will be found on a separate sheet [page iii] at the end of this volume. When binding Volumes 6 to 10, inclusive, into one book, the sheet [page iii at the end of the present volume] should follow page ii of the title sheet for Volumes 6-10, 1939-1943 that was published at the end of Volume 10.

Dedicated to
DR. HENRY A. JONES
in recognition of
his outstanding work in
Onion Breeding



Herbert Medalist — Dr. Henry A. Jones

NOTES ON THE GENUS *ALLIUM* IN THE OLD WORLD

ITS DISTRIBUTION, NAMES, LITERATURE, CLASSIFICATION AND GARDEN-WORTHY SPECIES

WILLIAM T. STEARN, *England*

The genus *Allium* comprises about 500 species. Their collective range covers almost the whole northern hemisphere, from the Atlantic coasts of Europe and North Africa to the Pacific and from the western to the eastern coast of North America. Most of them are to be found in temperate mountain regions with well-marked seasons, notably in California, northwestern Persia and Central Asia, but one species of immense range and great variability (*Allium Schoenoprasum*) extends into the Arctic, and a few occur in Tropical latitudes as far south as Abyssinia and Ceylon. In America no true *Allium* grows wild south of Mexico. *Nothoscordum* and *Ipheion* (*Beauverdia*) take the place of *Allium* in South America. The range of the genus thus embraces the Old World centers of early agricultural development and plant domestication in western Asia and China but does not reach the ancient American agricultural centers in Central America and the Andes. The alliaceous plants cultivated for food—onion (*A. Cepa*), shallot (*A. ascalonicum*) Welsh Onion (*A. fistulosum*), leek (*A. Porrum*), kurrat (*A. Kurrat*), garlic (*A. sativum*), rocambole (*A. Scorodoprasum*), cuchay or kiu ts'ai (*A. tuberosum*) and chives (*A. Schoenoprasum*)—are all of Old World origin. The North American Indian appreciated the flavor of the Alliums he found growing wild, but he never undertook their cultivation.

All true Alliums possess, though in varying degree, the pungent oniony taste and odor which indicates the presence of oil of garlic and related volatile oils having diallyl disulphide ($C_6H_{10}S_2$) or diallyl trisulphide ($C_6H_{10}S_3$) as a constituent. Those plants of *Allium*-like form which lack this alliaceous odor, and have at the same time their perianth-segments fused at base into a short tube and their ovaries furnished (as in some true Alliums, i. e. those belonging to Sect. *Melanocrommyum*) with numerous ovules in each chamber (locules), are best excluded from *Allium* and put in the genera *Nothoscordum* and *Caloscordum*. Of the genus *Nothoscordum*, the best known member is *N. inodorum* (Bot. Mag. t. 1129; *Allium fragrans*) now naturalized as a weed in many parts of the world; otherwise it is an exclusively American group, attaining its greatest number of species in the Andean region.

Long-cultivated plants usually exist in a multitude of forms, but these rarely coincide exactly with any wild form, and the region whence their ancestors were first taken into cultivation from the wild is thus uncertain; indeed, to recognize these ancestral species is often difficult, so greatly have the cultivated forms diverged from them. Chives (*A. Schoenoprasum*) and kiu ts'ai (*A. tuberosum*) match wild forms closely, but the origin of the onion (*A. Cepa*), Welsh Onion (*A. fistulosum*), leek (*A. Porrum*) and garlic (*A. sativum*) is more obscure. Undoubtedly

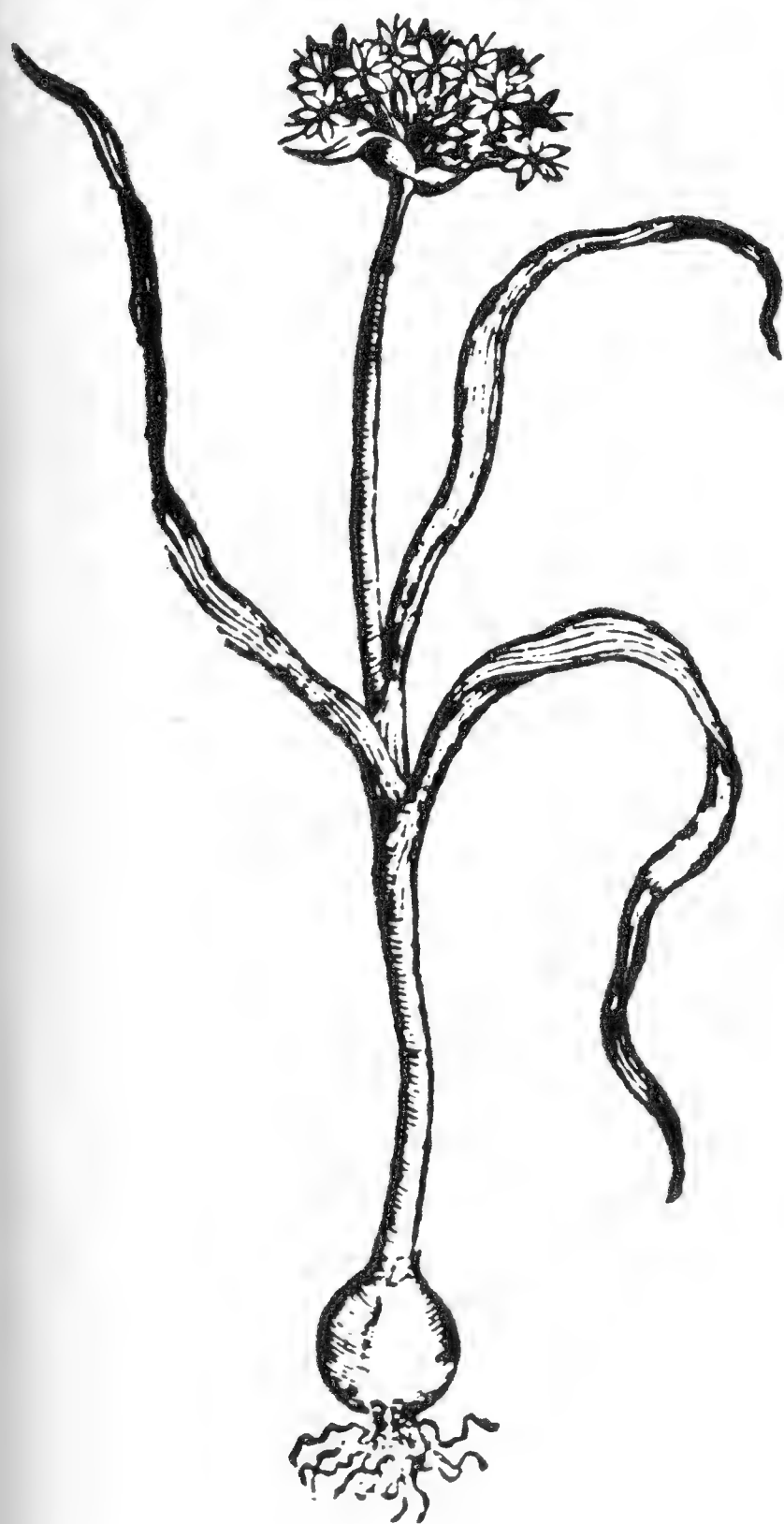
their cultivation began in the far remote past, long before the dawn of history. In north-eastern Persia, Afghanistan and the adjacent Pamir-Alai region of Soviet Central Asia are to be found the wild forms most resembling onion and leek. Welsh Onion, an important crop in China and Japan, has its nearest relative in *A. altaicum*, a species of southern Siberia, Mongolia and Eastern Turkistan. The leek probably originated in the eastern Mediterranean region and probably has *A. Ampeloprasum* as its remote ancestor.

The earliest records relating to the genus *Allium* naturally deal only with these economic plants and come from Egypt. In ancient Egypt, Juvenal and Pliny tell us mockingly, onion and garlic were esteemed as gods; the Egyptians took their oaths upon them. Specimens of onion, garlic and leek have been found in ancient Egyptian tombs. The Greek geographer Herodotus (5th cent. B. C.) saw an inscription in Egyptian characters on the Great Pyramid of King Cheops, which, according to his interpreter, recorded the quantity of radishes, onions and garlic eaten by the workmen who built it, and the money spent in this way was said to be 1600 talents of silver. This inscription no longer exists, but certain ancient Egyptian words in other inscriptions are interpreted as referring to onion, leek, garlic. Jewish tradition likewise testifies to the extremely ancient cultivation of these alliaceous crops in Egypt. When the Children of Israel wandered hungrily in the desert, they recalled with longing the appetizing foods of Egypt, "the fish which we did eat in Egypt for nought; the cucumbers and melons, and the onions and the garlick" (Numbers 11:5; compiled c. 900-750 B. C.). Since none of these plants are native to Egypt, their cultivation must have begun in yet more ancient times in the lands to the north-east, in Mesopotamia and beyond, whence the Egyptians first obtained them. They are thus among the oldest of plants cultivated for flavoring. Their cultivation spread through the Mediterranean lands long before the first Greek or Roman writers began to comment on the many varieties available. In ancient Rome and Athens, as in most Mediterranean lands today, garlic was a characteristic food of the poor. "Indeed", writes Bunyard, "of the many gifts that Europe owes to Asia, none, I imagine, have done more to reconcile man to a life of penury, than the vine and onion family. The laborer in Greek fields, with the traditional crust of bread, a skin of wine and a clove of garlic, could support his hard labor on those sunswept slopes. Even to-day his brother in England finds a lunch of bread and cheese a little tasteless without an onion."

Most of the European names of the onion, leek and garlic are of Latin origin. To the Romans garlic was known as *allium* or *alium*—obvious source of the modern French *ail*, Italian *aglio*, Spanish *ajo*—and this old vernacular name was adopted by Haller and Linnaeus in the eighteenth century as the scientific name of the whole genus. It is thus nowadays made to cover a multitude of plants bearing little obvious resemblance to its original owner; before the eighteenth century there existed no common name embracing them all like the scientific term *Allium* does today. The Latin name for the onion was *cepa* or *caepa* and this is the source of the modern Italian *cipollo*, Spanish *cebolla*,

German *Zwibel*. Later another word *unio*, probably at first a waggish slang-name, came into use among the Romans and from this, meaning "unity", and applied also to large pearls, and aptly distinguishing the single-bulbed onion from garlic with its many cloves, are derived the modern French *oignon* and English *onion*, of which there exist no less

Moly Dioscoridis



Moly minus

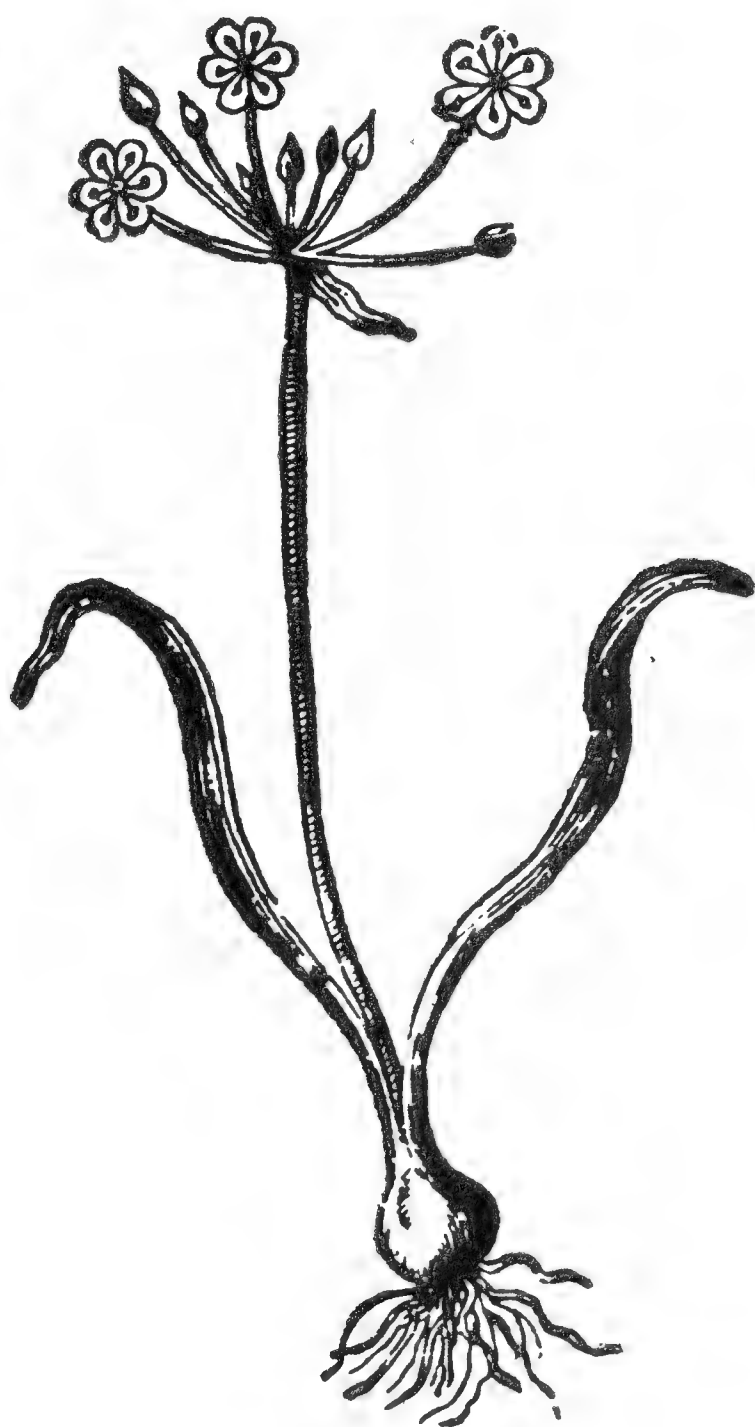


Figure 117. Left, *Allium subhirsutum* L., *Moly Dioscoridis* Clus.; right, *A. Clusianum* Retz., *M. minus* Clus. From Clusius, *Rariorum Plantarum Historia* (1601).

than nineteen old spellings. The leek was known as *prason* to the Greeks, *porrum* to the Romans, whence modern Italian *porro*, French *poireau*, Spanish *puerro*, but the Celtic, Germanic and Slavonic peoples had their own entirely different name, possibly meaning at first any cultivated herb, of which English leek (Anglo-Saxon *leac*), German *Lauch*, Dutch *look*, Swedish *lök*, Russian *luk* are modern variants. The English name

garlic (Anglo-Saxon *garleac*, i. e. spear-leek) is derived from this. The Greek names for leek, garlic and onion, i. e. *prason*, *skorodon* or *skordon* and *krommuon*, while they have contributed little to modern vernacular names, nevertheless form the base of many modern specific and sectional names in the genus, usually in the latinized forms—*prasum*,—*scordum* and—*crommyum*. The name *moly* has more romantic associations than these plebeian names with their neck of kitchen and cabbage-patch. *Moly*, Homer tells us, was the name by which the gods called the potent herb with milk-white flowers and black root wherewith Odysseus defied the spells and drugs of Circe, and so escaped the fate of his men, changed by her to swine. One would like to think of brilliant *Allium Moly* as being this magic herb, but the name *Moly* ought never to have been applied to that yellow-flowered Iberian plant which was unknown before the seventeenth century. *Moly* should have been kept for a white-flowered species of the Homeric lands.

“Garleek, oynons and eek lekes”, which Chaucer’s boozy Summoner loved so well, all through the Middle Ages, as in the earlier times, helped to liven the laborer’s dull food or hide its unsavory flavor, but no great increase in knowledge of the genus *Allium* came before the sixteenth century. Modern botanical nomenclature begins with Linnaeus’s *Species Plantarum* of 1753, wherein 31 species of *Allium* are named, but to understand his species and apply his names correctly it is necessary to delve into the writings of his predecessors. Sooner or later the enquirer arrives back at Clusius’s *Rariorum Plantarum Historia* (1601). Charles de L’ECLUSE (1526-1609), or Carolus CLUSIUS as he called himself when writing in Latin, was the leading botanist of the sixteenth century, a scholar with many accomplishments, upon whom, in his old age, the University of Leiden bestowed a professorship. Here, at Leiden, Clusius embodied into one large folio volume with woodcut illustrations, his celebrated *Rariorum Plantarum Historia*, all the material of his previous publications, the discoveries made on his travels in Hungary, Austria, Spain and elsewhere, the results of his life-long observation of plants. Clusius possessed the gift of detecting the essential specific features of plants and so triumphed over the limited scientific terminology of his day as to give recognizable accounts of more *Alliums* than any previous author. It is fitting that one of them (Fig. 117, right) should be named *A. Clusianum* in his honor. The others include *A. Victoralis*, *A. Ampeloprasum*, *A. controversum*, *A. nigrum*, *A. subhirsutum*, *A. Scorodoprasum*, *A. carinatum*, *A. flavum*, *A. paniculatum*, *A. rotundum*, *A. agulosum*, *A. montanum* and *A. Moly*. He must also have known the common onion, leek, garlic, chives, crow garlic (*A. vineale*) and ramsons (*A. ursinum*), already well illustrated in the works of Brunfels (1489-1534), Fuchs (1501-66) and Mattioli (1500-1577), but he probably considered them too common for inclusion in a volume devoted to rare plants. In the history of *Allium*, as in many other genera, Clusius’s work is a landmark; it can almost be described as the starting point of our modern knowledge. Figs. 117, 118, and 120 show typical illustrations from the *Rariorum Plantarum Historia*. Linnaeus cited Clusius’s *Moly Dios-*

coridis from Cadiz (Fig. 117, left) when publishing *A. subhirsutum* Linn.; Retzius's *A. Clusianum* is partly based upon Clusius's *Moly minus* (Fig. 117, right). These illustrations thus help to typify the species of later authors. Clusius placed his species under the generic headings *Victorialis*, *Scorodoprasum*, *Moly*, *Allium sive Moly montanum* and *Moly Narcissi foliis*. Later authors treated the onion, leek and garlic as members of different genera; *Cepa*, *Porrum* and *Allium*. The first to bring all the alliaceous plants under one heading, to adopt the name *Allium* for this and so to give the name its present wide application and the genus its present definition, seems to have been the Swiss anatomist, botanist, bibliographer, and poet, many-sided Albrecht von HALLER (1708-77). Haller's most important scientific work was in the field of human anatomy and physiology, but his encyclopaedic mind was as competent as that of Linnaeus in botanical matters and equally versed in botanical literature. In 1745 Haller published at Goettingen the first monograph of the Genus, *De Allii Genere naturali Libellus*, a pamphlet of 56 pages with two engraved plates, later republished, with alterations, in his *Opuscula* (1749). It examines the views of Morison, Tournefort, Magnol, Ray, Knaut, Micheli, Ruppius, Boerhaave, Rivinus, Heucher and Linnaeus upon the definition of the genus, then carefully disentangles the synonymy of the 24 species then known and describes them in considerable detail; it also states their distribution with as great accuracy as the limited collecting of the period allowed. This work is the basis of the account of *Allium* by Carl von Linné (1707-78), better known as Linnaeus, in his *Species Plantarum* (1753). Here the cumbersome descriptive phrase-names used by Linnaeus's predecessors and contemporaries are swept into synonymy and replaced by convenient binominals. Thus for Haller's *Allium foliis radicalibus subhirsutis, caulinis glabris, floribus umbellatis* Linnaeus substituted the name *Allium subhirsutum*, but in order to ascertain what he meant by this it is necessary to refer back to Haller's work and, ultimately, to that of Clusius.

An enormous amount of literature relating to *Allium* has been published since 1753. It must suffice to mention here only a few important illustrated and monographic works.

On his travels in the Orient, a region wherein Alliums abound, John Sibthorp (1758-96), the Sherardian Professor of Botany at Oxford, was accompanied by Franz Bauer (1758-1840), an Austrian, who has been considered the greatest of botanical artists, "der groeste Pflanzenmaler". Bauer drew and painted the plants in a living state as he and Sibthorp found them in Greece, the Aegean islands, Asia Minor and Cyprus. The 16 plates of *Allium* by Bauer in Sibthorp and Smith's *Flora Graeca* 4: tt. 312-327 (1823) are equalled only in beauty and accuracy by those in Redoute's *Les Liliacées* (8 vols., 1802-16).^{*} This fine work devotes 35 plates to *Allium*, the species figured being those available in French gardens at the time. Pierre Joseph Redouté

^{*} The dates of publication of Redoute's *Liliacées*, as established by B. B. Woodward in *Journ. of Bot.* 43:26 (1905), are as follows:—Vol. 1: tt. 1-18 in 1802, tt.

(1761-1841), who can justly be rated Bauer's equal as a botanical artist, painted the illustrations, but the text of vols. 1-4 was written for him by A. P. de Candolle (1778-1841), 5 and 6 by François de la Roche (d. 1813), 7 and 8 by A. Raffeneau Delile (1778-1850). The plates in H. G. Ludwig Reichenbach's *Icones Florae Germaniae et Helveticae* do not reach the high quality of Redouté's and Bauer's; vol. 10 tt. 482-508 (1848) nevertheless contains an extremely useful series of illustrations of almost all the European species of *Allium*. There are also many colored plates of *Allium* scattered through Curtis's *Botanical Magazine*.

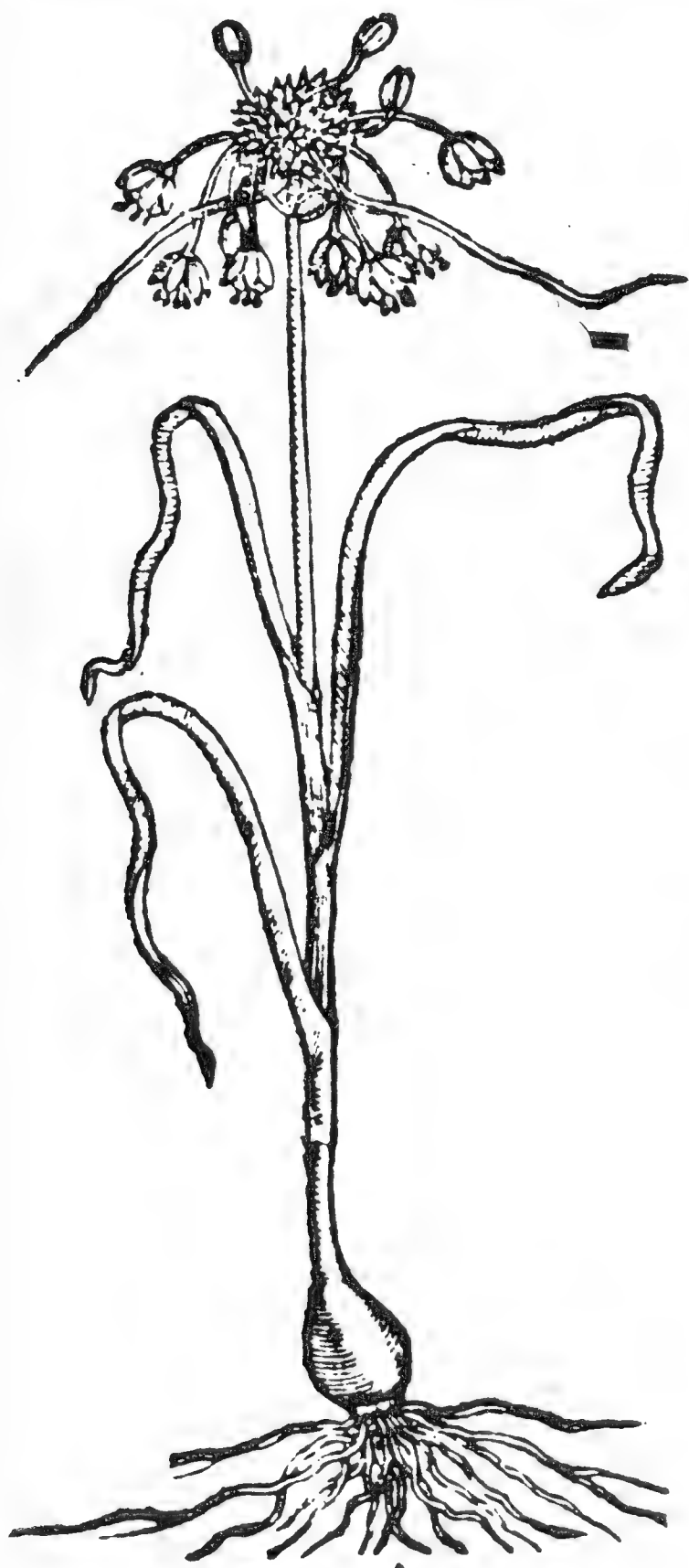
Of monographic works since Haller's, the first was *A Monograph of the Genus Allium* by George DON the younger (1798-1856), which was read to the Wernerian Natural History Society of Edinburgh in April 1826 and published in vol. 6:1-102 of the Society's *Memoirs*, the latter being dated "1832". A separate edition, however, came out early in 1827. Don based his work on the rich Lambert herbarium, later divided and scattered, and on the plants grown in the Chelsea Physic Garden. A gardener by training, he had a keen eye for differences between individual plants and tended to regard such differences as of specific value; consequently many of the 139 species he recognized have since been reduced. The generally accepted division of the genus *Allium* into the sections *Porrum*, *Macrospatha*, *Schoenoprasum*, *Molium* and *Rhizirideum* was first proposed by Don. The value of his work today lies primarily in its citations of pre-Linnean literature ignored by Regel.

The *Alliorum adhuc cognitorum Monographia* by Eduard von REGEL (1815-92) is the last survey of the genus *Allium* as a whole. It was published at Leningrad in 1875 as part of *Acta Horti Petropolitani*, vol. 5. The descriptions and key are in Latin, the introduction and notes in German. In working through the collections sent home from Turkistan by the explorers Alexis and Olga Fedtschenko, Regel came upon species after species which did not fit any of the descriptions in C. S. Kunth's *Enumeratio Plantarum* 4:379-450, 684-691 (1843), a compilation which brings together information from a great variety of works, and ultimately he found himself obliged to monograph the entire genus. In this he included *Nothoscordum*, *Caloscordum* and *Nectaroscordum* as well as species of *Triteleia*, *Muilla* and *Bloomeria*, making 263

19-24 in 1802 or 1803, tt. 25-48 in 1803, tt. 49-60 in 1804; Vol. 2: tt. 61-102 in 1804, tt. 103-120 in 1805; vol. 3: tt. 121-138 in 1805, tt. 139-162 in 1806, tt. 163-180 in 1807; vol. 4: tt. 181-204 in 1807, tt. 205-240 in 1808; vol. 5: tt. 241-276 in 1809, tt. 277-300 in 1810; vol. 6: tt. 301-348 in 1811, tt. 349-360 in 1812; vol. 7: tt. 361-402 in 1812, tt. 403-420 in 1813; vol. 8: tt. 421-444 in 1814, tt. 445-468 in 1815, tt. 469-486 in 1816. The *Allium* plates are *A. album*, t. 300; *Ampeloprasum*, t. 385; *arenarium*, t. 379; *bisulcum*, t. 286; *brachystemon*, t. 374; *carinatum*, t. 368; *carolinianum*, t. 101; *cernuum*, t. 345; *Chamaemoly*, t. 325; *ciliare*, t. 311; *denudatum*, t. 357; *flavum*, t. 119; *foliosum*, t. 214; *fragrans*, t. 68; *globosum*, t. 179; *longispathum*, t. 316; *lusitanicum*, t. 27; *Moly*, t. 97; *moschatum*, t. 100; *mutabile*, t. 240; *nigrum*, t. 102; *nutans*, t. 233; *obliquum*, t. 363; *obtusiflorum*, t. 118; *pallens*, t. 272; *paniculatum*, t. 252; *roseum*, t. 213; *scorzonnerifolium*, t. 99; *sphaerocephalon*, t. 391; *striatum*, t. 50; *subhirsutum*, t. 305; *sulcatum*, t. 482; *tataricum*, t. 98; *triquetrum*, t. 319; *ursinum*, t. 303; *Victorialis*, t. 265.

species in all. Later, in 1887, Regel published a supplementary work, *Allii Species Asiae Centralis* (*Acta Horti Petrop.* 10: 278-362) illustrated with drawings that are neither accurate nor artistic.

Allium five Moly montanum II. 324



Allium seu Moly montan. latifol. I.

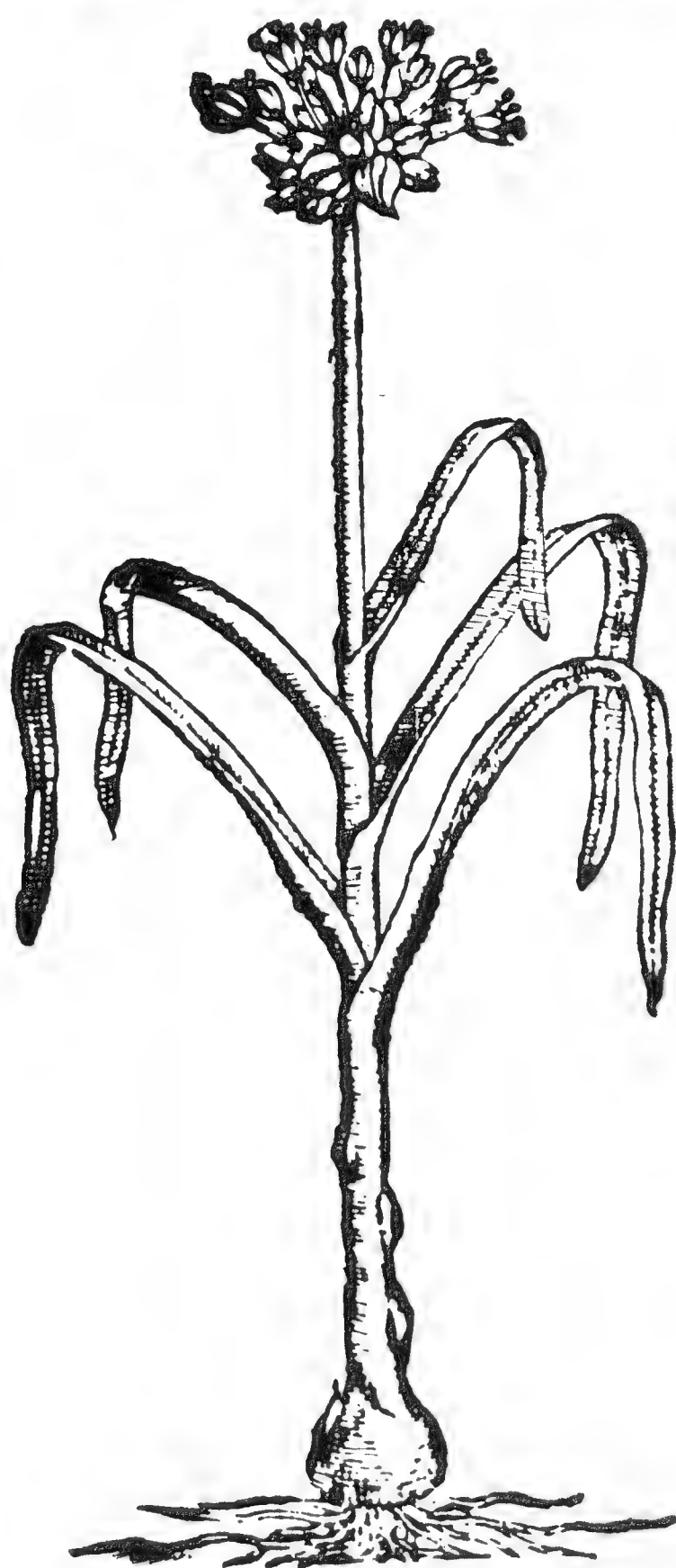


Figure 118. Left, *Allium carinatum* L., *Allium s. Moly montanum II* Clus.; right, *A. Scorodoprasum* L., *A. s. M. montanum I* Clus. From Clusius, *Rariorum Plantarum Historia* (1601).

In 1882 the Genevese botanist Edmond Boissier (1810-85) published in his *Flora Orientalis* 5: 229-285, an account of the species occurring in the territory from Greece and Egypt eastward to the boundaries

of India. This includes 141 species as well as many varieties, some of which are now given specific rank.

These two works made unnecessary a survey of the genus by the Kew botanist John Gilbert BAKER (1834-1920) who was then engaged on a revision of the petaloid monocotyledons. Baker did, however, write the text accompanying many plates of *Allium* in the *Botanical Magazine*.

Of recent publications the most important is A. VVEDENSKY'S account of *Allium* in the Soviet Union, forming part of Komarov, *Flora URSS* 4 (1935), which not only provides detailed and accurate descriptions in Russian of 225 species, but fits into a systematic framework and points out the distinguishing features of the many species discovered in the Caucasus and Russian Central Asia since the comprehensive works of Regel and Boissier. No less than 40 of these had been described previously by Vvedensky himself, mostly in periodicals not readily accessible.

Up to the present well nigh 1100 specific names have been proposed in the genus *Allium* and have to be accounted for by the next monographer, but about 600 of them may prove to be synonyms. Thus reduced, *Allium* will, nevertheless, remain a vast almost unwieldy genus. To understand it, related species must be grouped together and this is no easy task. Difficulty arises from the features which give the genus its fascination—the great diversity of structure which its species display, their many different combinations of characters. No organ remains constant in form throughout the genus and all must be considered in building a natural classification. Much attention has been given to the outward form and the outer coverings of the bulb but very little to its internal structure, which varies immensely from group to group. The veneration of the leaves and the characters of the capsules, seeds and seedlings also offer promising fields of enquiry.

The first to appreciate the great morphological variation of the group and to attempt “to divide it into Genera from the various Structure of the Bulb, Leaves, Bractes, Petals, Filaments, Stigmata, Fruits and Seeds” seems to have been Richard Anthony SALISBURY (1761-1829). He was an extremely acute observer, whose whole life was devoted to the study of plants. During his life-time he published nothing of consequence on the genus, but 37 years after his death J. E. Gray printed a fragment of his manuscript “*Genera Plantarum*” dealing with petaloid monocotyledons. Here the “*Order Cepaceae*”, as Salisbury termed the group, is divided into 18 carefully characterized “legitimate Genera, differing often materially not only in Leaves and Flowers, but in their Fruits and Seeds, which latter Haller and Linné neglected to examine”. Every line reveals how closely he had studied these plants in a living state. He confesses, however, that he found “the smell of *Cepaceae* * * * frequently so intolerable that after dissecting about half the species in our collections, I abandoned the rest”. Such features as the form of the nectary and the number of ovules in each chamber of the ovary did not escape him. His “Genera” accordingly represent fairly natural groups

worthy of sectional rank, and in the interval between his death in 1829 and the publication in 1866 of his *Genera of Plants*, a *Fragment containing Part of Liriogamae*, many of them were published as sections of the genus *Allium* by other authors and some have been recently described as new sections by F. Hermann. C. S. Rafinesque (1783-1840) likewise considered that "several ancient Genera, Onion, Leek and Garlick, were blended by L[innaeus] without just cause" and he too attempted a "generic reform" by splitting *Allium* into 13 new genera, scrappily defined and by no means so well-founded and homogeneous in content as Salisbury's. Indeed the contrast between Salisbury's precise and scholarly *Genera*, many times rewritten but to the author's mind never perfect enough for publication, and Rafinesque's muddled *Flora Telluriana* (1-3, 1837; 4, 1838; not 1836; cf. Barnhart in *Torreyana* 7, 177:1907), with its hundreds of imperfectly studied and ill-defined "generic groups", is well exemplified in their treatment of the genus *Allium*.

George Don in 1827 divided the genus into eleven "divisions" (each with a description and a Roman number) and these he subdivided into "sections" (each with a description and an Arabic number). The eleven divisions he grouped under seven apparently subgeneric names—*Porrum* (comprising Divisions I-II), *Schoenoprasum* (Div. III), *Macrospatha* (Div. IV-VI), *Rhizirideum* (Div. VII), *Molium* (Div. VIII-IX), *Anguinum* (Div. X) and *Ornithogalodeum* (Div. XI)—which, however, lack descriptions, so that their essential characters have to be deduced from those common to the divisions comprised in each. The names *Porrum*, *Macrospatha* and *Molium* all cover more than one division and are in a sense *nomina nuda*; their nomenclatural standing is debatable. Don's classification proved an important contribution to a system of the genus and was adopted with little change by Roemer and Schultes in 1830, by Kunth in 1843, by Regel in 1875 and by Engler in 1888.

In the year that Don's monograph first appeared the Belgian politician Barthelémy Charles DUMORTIER (1797-1878) published at Tournay a *Florula Belgica* in which he attempted to divide the genera of the Belgian flora into natural sections. His section *Alliotypus*, with the filaments of the alternate stamens broadened and tricuspidate and comprising *A. Porrum*, *A. sativum*, *A. Scorodoprasum*, *A. sphaerocephalon*, *A. vineale* and *A. Ascalonicum*, corresponds to Don's group *Porrum* and the name *Alliotypus* appears to be the correct title. Dumortier's other section *Schoenoprasum*, with undivided stamens, is less natural; it includes *A. Schoenoprasum*, *A. oleraceum*, *A. flavum*, *A. carinatum*, *A. Moly* and *A. ursinum*, species of very unlike character representing four distinct sections.

In December 1836, Stephen ENDLICHER (1804-49) proposed in his *Genera Plantarum* the division of the genus *Allium* into four sections:—(a) *Moly* corresponding to Don's *Molium*; (b) *Ophioscorodon* (Wallr.) based on *A. ursinum*; (c) *Codonoprasum* (Reichenb.) corresponding to Don's *Macrospatha*; (d) *Schoenoprasum* (Kunth) corresponding to Don's *Porrum*, Dumortier's *Alliotypus*.

Another classification was put forward in 1848 by Philip Barker WEBB (1793-1854) in his *Phytographia Canariensis*. He separated the species with more than two ovules in each chamber of the ovary from those with only two ovules, naming the first *Melanocrommyum* (from the Greek words for black and onion, in allusion to the type species, *A. nigrum*), the second *Crommyum*. Boissier in 1882 accepted these as primary divisions of the genus and then subdivided the section *Crommyum* into the subsections *Porrum*, *Rhizirideum* and *Haplostemon*, the last being further divided into series *Schoenoprasum*, *Brachyspatha*, *Codonoprasa* and *Molia*.

In 1939 F. Hermann published a short review of the sections and subdivisions of *Allium* in Europe, directing attention to the valuable taxonomic characters presented by the nectaries and by the leaf-vernation. Most of Hermann's new sections correspond to genera described by Salisbury, while some of them are identical with sections already well-established in the literature and for which new names such as *Melamprason*, *Rhynchoprason*, *Nikeprason* and *Arktoprason* are superfluous.

None of the classifications yet proposed, however, is adequate for the satisfactory disposition of the vast number of species now known. All are to some degree artificial, being based upon too limited a range of characters and hence incapable of giving a true picture of the complex inter-relationships necessarily existing in so large a genus. The writer cannot at present supply the new classification that is so manifestly needed but would suggest that the following sections* may be provisionally recognized:—

MELANOCROMMYUM Webb et Benth. (1848); syn. sect. *Melamprason* F. Hermann (1939), genus *Panstenum* Raf. (1837), genus *Canidia* Salisb. (1866); type-species, *A. nigrum* (Bot. Mag. t. 1148), sect. *Kaloprasum* C. Koch (1849)†.

MOLY Endl. (1836), syn. sect. *Molium* G. Don ex Koch (1837), sect. *Rhodoprason* F. Hermann (1939), sect. *Crommyum* subsect. *Haplostemon*, *Molia* Boiss. (1882), genus *Iulus* Salisb. (1866), genus *Molium* (G. Don) Fourr. (1869); type-species, *A. neapolitanum* (Bot. Mag. t. 3531) or *A. roseum* (Bot. Mag. t. 978).

BRISEIS (Salisb.) Stearn, sect. nov. (1946); syn., genus *Briseis* Salisb. (1866)*; type-species, *A. triquetrum* (Bot. Mag. t. 869).

* For the original publication of these, see Dumortier, Fl. Belg. 140 (1827); Endlicher, Gen. Pl. 146(1836); Koch, Synop. Fl. Germ. 714(1837); Rafinesque, Fl. Tellur. 2. 17(1837); Kunth, Enum Pl. 380(1843); Webb et Berthelot, Hist. Nat. Iles Canaries, Bot. 3. 347(1848); Salisbury, Gen. Pl. 88(1866); Boissier, Fl. Orient. 5. 229(1882); Maximowicz in Bull. Acad. Sci. St. Petersburg. 31. 109(1887); Prokhanov in Bull. Appl. Bot. (Leningrad) 24. ii. 176(1931); F. Hermann in Fedde, Repert. Sp. Nov. 46. 57(1939).

† Sect. *Kaloprasum* C. Koch in Linnaea 22. 235 (1849) is based on *A. caspium* (Bot. Mag. t. 4598) which diverges from other species of sect. *Melanocrommyum* in its rather more campanulate perianth and its much longer stamens and style.

* "*Briseis*. Petala disco basis coalita, recurva, oblonga, interiora angustiora post anthesin conniventia et scariosa. Filamenta supra basin petalorum 2 seriebus inserta, subulata. Pericarpium turbinatum. Stylus 3-fidus. Stigmata 3, hemisphaerica. Semina arillata * * * Nomen poeticum ob fructos cernuos * * * *Briseis* differs from every other Genus here, in its extremely narrow filaments inserted in

MICROSCORDUM Maxim. (1887); type-species, *A. monanthum*.

CHAMAEPRASON F. Hermann (1939); syn., genus *Saturnia* Maratti (1772); type-species, *A. Chamaemoly* (Bot. Mag. t. 1203).

XANTHOPRASON F. Hermann (1939); syn., genus *Molyza* Salisb. (1866); type-species, *A. Moly* (Bot. Mag. t. 499).

OPHIOSCORODON (Wallr.) Endl. (1836); syn., sect. *Arktoprason* F. Hermann (1939); genus *Ophioscorodon* Wallroth (1822), genus *Hylogeton* Salisb. (1866); type-species, *A. ursinum*.

CEPA (Moench) Prokhanov (1931); syn., genus *Cepa* Moench (1794) p. p., amend. Salisb. (1866). genus *Kepa* Raf. (1837) p. p.; type-species, *A. Cepa*.

PHYLLODOLON (Salisb.) Prokhanov (1931); syn., genus *Phyllodolon* Salisb. (1866); type-species, *A. fistulosum* (Bot. Mag. t. 1230).

HAEMOPRASON F. Hermann (1939); syn., sect. *Schoenoprason* Regel (1875) p. p. maj., sect. *Crommyum* subsect. *Haplostemon* § *Brachyspatha* Boiss. (1882); type-species, *A. melananthum*.

CODONOPRASUM (Rehb.) Endl. (1836); syn. sect. *Macrospatha* G. Don ex Kunth (1843), sect. *Rhynschoprason* F. Hermann (1939), sect. *Crommyum* subsect. *Haplostemon* § *Codonoprasa* Boiss. (1882), genus *Codonoprasum* Reichenbach (1828), genus *Raphione* Salisb. (1866); type-species, *A. oleraceum*.

RHIZIRIDEUM G. Don ex Koch (1837); syn. genus *Endotis* Raf. (1837), genus *Xylorhiza* Salisb. (1866), genus *Butomissa* Salisb. (1866), genus *Rhizirideum* (G. Don) Fourr. (1869); type-species, *A. senescens*. Here may belong the genera *Gynodon* Raf. (1837) and *Calliprena* Salisb. (1866), both based on *A. cernuum* (Bot. Mag. t. 1324), and the genera *Stelmesus* Raf. (1837) and *Hexonychia* Salisb. (1866), both based on *A. stellatum* (Bot. Mag. t. 1506).

ANGUINUM G. Don ex Koch (1837); syn. sect. *Nikeprason* F. Hermann (1939), genus *Loncostemon* Raf. (1837), genus *Berenice* Salisb. (1866), genus *Anguinum* (G. Don) Fourr. (1869); type-species, *A. Victorialis* (Bot. Mag. t. 1222).

ALLIOTYPUS Dumortier (1827); syn. sect. *Schoenoprasum* (Kunth) Endl. (1836) non Dumortier (1827), sect. *Porrum* G. Don ex Koch (1837), genus *Schoenoprasum* Kunth (1815), genera *Getuonis*, *Plexistena* and *Stemodoxis* Raf. (1837), genus *Porrum* Salisb. (1866); type-species, *A. Porrum* or *A. sativum*.

NOTHOSCORDUM Kunth (1843), CALOSCORDUM Herbert (1844) and NECTAROSCORDUM Lindley (1836) are considered separate genera.

If the definition of the sections is difficult, far more so is that of the species. No herbarium adequately represents the whole genus and in any event herbarium specimens need to be supplemented by living plants, for they often lack bulb, leaves, spathe or capsule, all of which may be necessary in order to place a species in its proper group and to

two series, and arillated Seeds; its Leaves are so sharply keeled as to appear triangular like those of *Carex*, and its Peduncle which is triangular soon bends down to the ground from the weight of its fruits" (Salisb. Gen. Pl. 92-94. 1866). Briseis was the favorite slave of Achilles; her seizure by Agamemnon led to the quarrel between Achilles and Agamemnon which is the theme of the first part of the Iliad.

identify it with certainty. The identification of incomplete *Allium* specimens, as of garden plants whose provenance has been forgotten, is no easy task under present conditions.

This lack of certainty is much to be regretted, for the genus offers many decorative plants to the keen gardener and many interesting problems to workers in plant-anatomy, physiology and cytology, to all of whom correct nomenclature is important. Chouard's work on the bulbs, seedlings, etc., of *Scilla* (*Ann. Sci. Nat. Bot.*, 10e sér. 13. 131-323. 1931) suggests the desirability of similar work on *Allium*. Levan's cytological researches (*Hereditas* 13. (1929) et seq.) have contributed to an understanding of the relationship between various species and of the variation in certain groups; most of these he examined proved to be diploid, but a number of polyploids (morphologically not greatly different from the corresponding diploids) also exist and possible correlations of geographical distribution and cytological characters need study. The fruit-biology of the genus, briefly sketched by Sernander in his monograph on the dispersal of seeds and fruits by ants (*Kungl. Svenska Vet. Akad. Handl.* 41, no. 7, pp. 260-264. 1906), presents other problems.

The gardener values plants for their use and appearance rather than their biological peculiarities. The culinary importance of onion, leek, shallot and chives hardly needs mention, but many other species can likewise be eaten. Although some are unpalatable, none are known to be poisonous. Explorers in North America, China, Tibet, Turkistan, Afghanistan, Siberia and North Africa mention a great variety of species as being gathered in a wild state and eaten by native peoples. Ramsons (*A. ursinum*) was more esteemed in former times in Europe than it is at present, but makes a good substitute for garlic. The little bulbils of *A. paradoxum*, a weed in some gardens, can be added to salads. Chinese chives, cuchay or kiu ts'ai (*A. tuberosum*), which in Europe and America is grown only for ornament, in the Far East is much esteemed as a salad-plant. From August to October its clumps of profuse grassy leaves are overtopped by angled stems a foot or so high bearing starry white flowers in umbels 1½ inches or so across. These flowers have a pleasant hawthorn-like scent. To salads they impart a honeyed sweetness as well as a garlic pungency, while the leaves can be used like those of chives.

Coming to Alliums of decorative value, "of the whole Family, there are a great many which I must leave", as three centuries ago Parkinson was obliged to do, and like him, "I will only select out a few for this our Garden, whose flowers for the beauty of stateliness, form or colour, are fit to be entertained, and take place therein, every one according to his worth, and are accepted of by the lovers of these delights", adding words of warning about some others. The cultivation of Alliums offers no difficulty. In nature most species grow in well-drained rocky places, amid sparse vegetation, on sunny exposed slopes, and in the garden a light soil and a sunny position suit them best. Those of low stature obviously ask for homes in the rock garden. *A. paradoxum*, *A. triquetrum*, *A. ursinum* and *A. Victorialis* are exceptional in being often woodland plants in nature and therefore thriving well under shady conditions in

the garden. *A. paradoxum* has no particular merit. Its three-sided stem, about 6 to 12 inches high, ends in a cluster of bulbils, out of which one fairly large white cup-shaped flower rises on a slender curved pedicel. These bulbils provide an all too efficient means of increase. It is a native of the Caucasus and north Persia but has become naturalized in parts of Europe. Strangely enough, it was first described as a species of *Scilla*! Its stigma is trilobed, a feature not common in the genus *Allium* and one which connects it with *A. triquetrum* (*Bot. Mag.* t. 869). This is a handsome plant of very easy cultivation; in fact it needs no cultivation—only to be left alone. Above its clumps of grassy leaves, on three-sided stems 9 to 12 inches high, droop one-sided umbels of large white bell-shaped flowers (Plate 255-a), each segment marked down the outside with a conspicuous green stripe. After flowering the perianth dries around the swelling capsule and the stem becomes limp, bending over and resting upon the ground by the time the seeds are ripe. Ants find the aril, with which the seeds are provided, very appetizing and carry them about the garden. *A. triquetrum* has a fairly wide range in the western Mediterranean region and is eaten in North Africa. Regel united with it *A. pendulinum*, a less robust species of southern Italy and Corsica. This has more slender leaves and stems; the umbel is not markedly one-sided as in *A. triquetrum*, the pedicels curving instead in all directions; the perianth opens widely, saucer-fashion, at anthesis, instead of being permanently bell-shaped; the perianth-segments are narrowly elliptic, rather than narrowly oblong, and smaller (about 1 cm. or less against 1.5 cm. or more in *A. triquetrum*). It has been in cultivation but, lacking the robust nature of *A. triquetrum*, it has died out and needs re-introduction. *A. triquetrum*, on the other hand, has become naturalized in southern England.

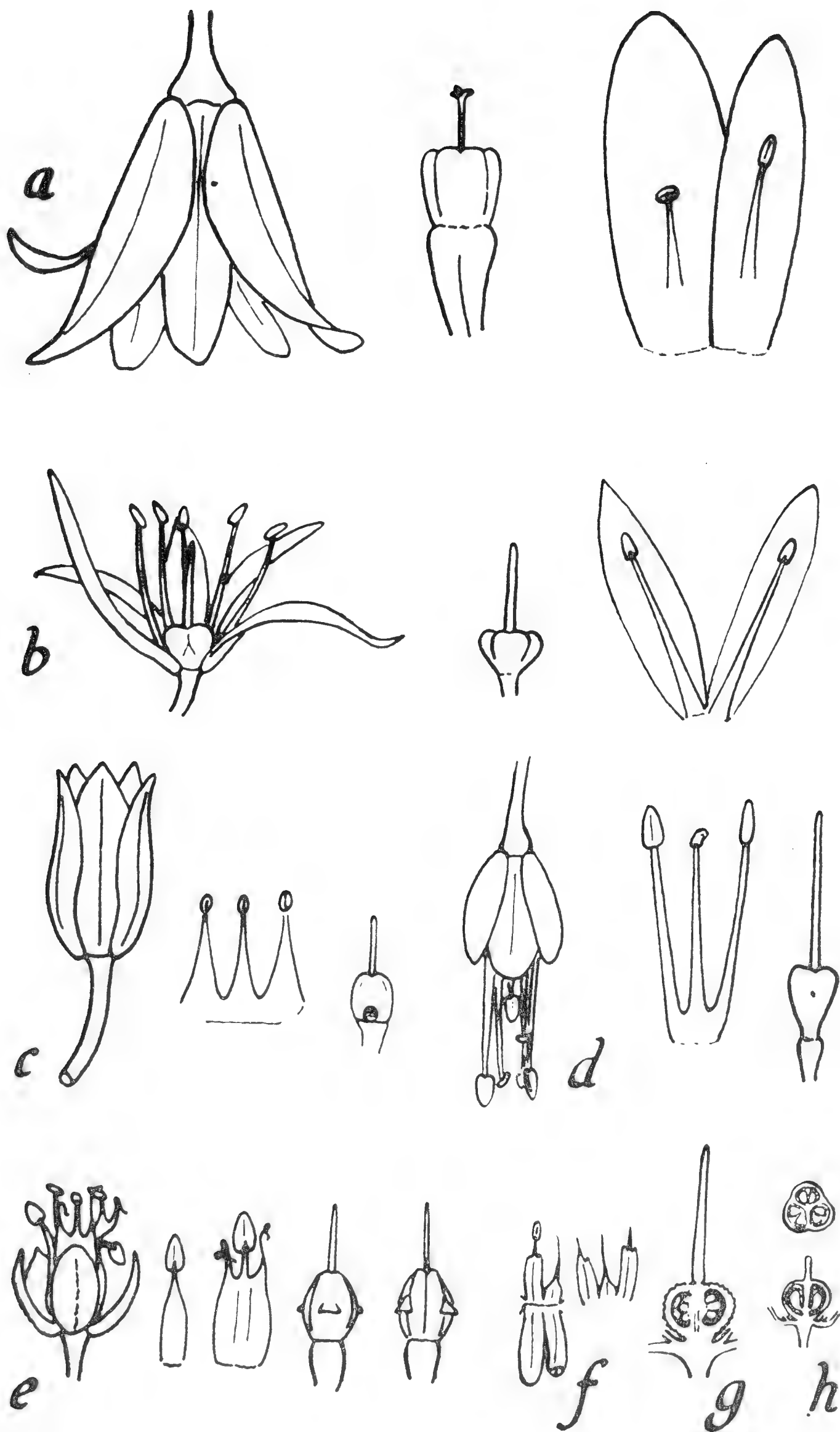
The peculiarity of seed-dispersal by ants noted for *A. triquetrum* has also been observed in *A. ursinum*. Here again the three-sided stem becomes limp after flowering, ultimately lying flat upon the ground and bringing its globular seeds within easy reach of ants; there is no aril but, according to Sernander, the seed-coat is impregnated with oil. What connection this species has with bears is now uncertain; the German name *Baerenlauch* probably originated as a translation of the Latin name *allium ursinum*, which goes back to the first century A. D., being mentioned by Pliny, to a time, that is, when wild bears were much commoner in Europe than they are now. Its English name is *wild garlic* or *ramsons* (Old English *hramsa*), an interesting and ancient word cognate with Russian *cheremsha* and Greek *crommyum* and obviously the same as Swedish *ramslök* and Dutch and German *rams*. In late spring *A. ursinum* carpets many an English wood with its broad, lanceolate or narrowly ovate leaves and often tricks the inexperienced into thinking they have found Lily-of-the-Valley (*Convallaria*). Its strong odor quickly proclaims its identity. The bulb is long and slender, with a truncate top where the leaf-stalk has fallen off, and is formed from the base of a single leaf. The leaves are a fresh green above, and a glaucous green below, but the "lower" side is morphologically the

upper side, for by a twist in the petiole the leaf has been turned upside down, a phenomenon well-known in *Alstroemeria* but not in *Allium*. The starry white flowers (Plate 255-b) are produced in great abundance. Like *A. triquetrum* it needs no cultivation, merely to be left alone and allowed to colonize some dark unconsidered spot. It is the only member of the section *Ophioscorodon*.

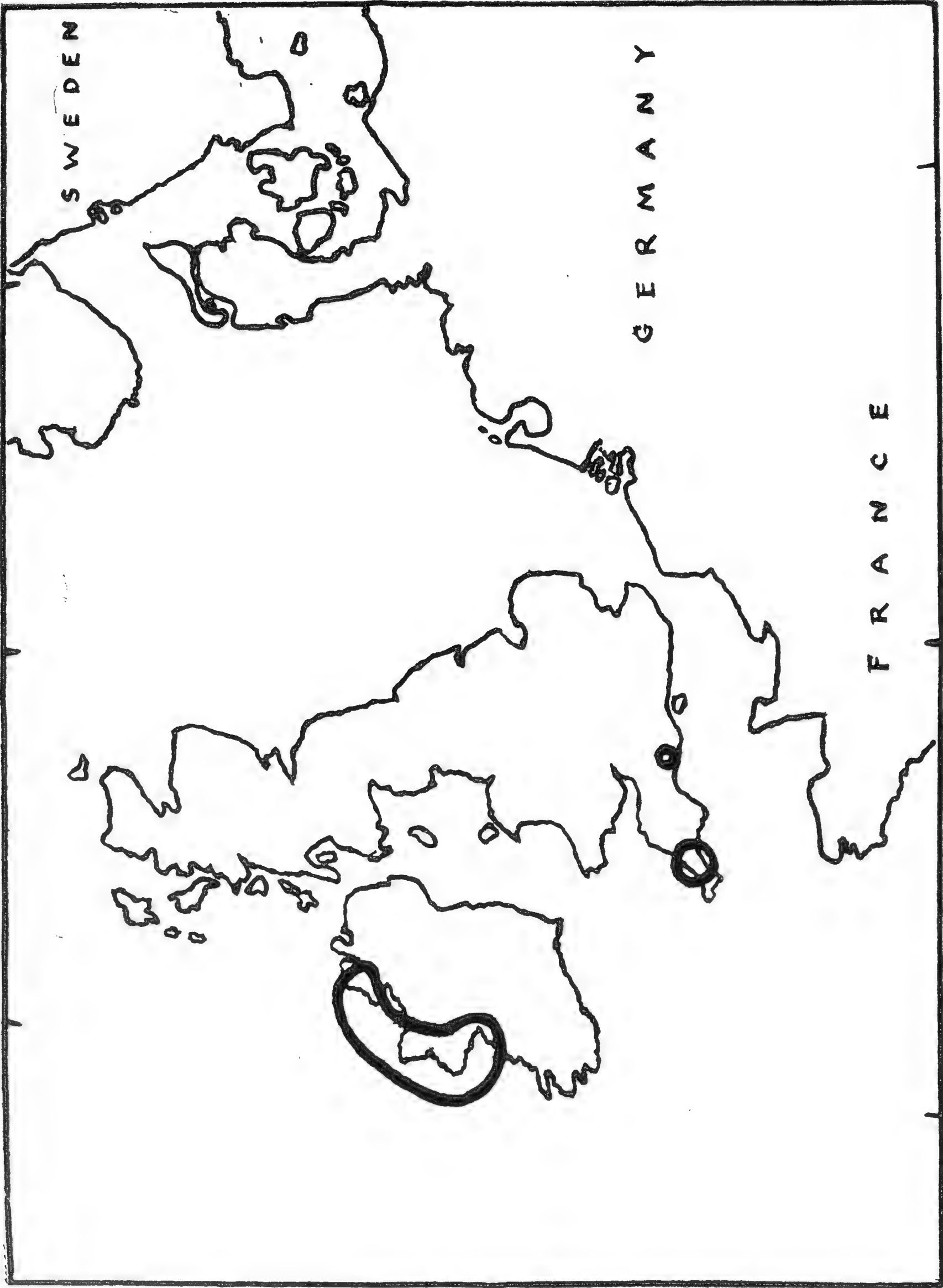
A. Victoralis (*Bot. Mag.* t. 1222) is an interesting but hardly ornamental species of wide distribution. In Siberia, under the name *cheremsha*, it is gathered and stored as a preventive of scurvy; like *A. ursinum* it has a strong garlic flavor. The leaves are broad, firm-textured, dark green, several times folded, not rolled, when young; their sheaths are purple; netted fibrous tunics envelop the oblong bulbs, which are mounted on a rhizome. The flowers are yellowish and very small, with long protruding stamens. The herbalist's name *Victoralis* commemorates the medieval superstition of German miners in Bohemia, who called it *Siegwurz* ("victory-root") and believed that it warded off evil spirits liable to attack them underground. This reputation it shares with the herb Moly, which protected Odysseus against the designs of Circe, and with garlic, which was reputed to keep off vampires; those who dislike garlic find themselves in bad company.

A. Moly (*Bot. Mag.* t. 499) has no connection with the Moly of Homer but is a broad-leaved handsome plant with large, bright yellow, glossy, saucer-shaped flowers on stems about a foot high. It increases rapidly. When Regel published his monograph in 1875, all he could say about the provenance of this species was that it grew in southern Europe. Now it is known from southwestern France [dep. Aude; cf. Timbal-Lagrave in *Bull. Soc. Bot. France* 17. 211 (1880); Petit in *Bull. Soc. Sci. Aude* 7 (1896)], Spain and Portugal. *A. stramineum* Boiss. et Reut., non Regel, is the only related species and has narrower leaves and pale flowers. *A. Moly* var. *bulbilliferum* carries bulbils in the umbel and is not so ornamental as the type. *A. Moly* is the type-species of section *Xanthoprason*.

The *Molium* garlics centre on *A. neapolitanum*. They have small more or less globose bulbs, linear leaves parting from the stem at or slightly above the ground-level, and fairly large white or pink saucer-shaped flowers; there are two ovules (not more) in each chamber of the ovary (Plate 255-h). *A. neapolitanum* has large white flowers and is an attractive species much used for forcing and pot-cultivation. The leaves are hairless but have a minutely toothed edge; the stem is three-angled. These characters separate it from a group of other Mediterranean species with round stems and hairy-edged leaves, *A. subhirsutum*, *A. Clusianum*, *A. ciliatum* (*Bot. Mag.* t. 774), *A. trifoliatum*, *A. Blomfieldianum*, *A. Chamaemoly* (*Bot. Mag.* t. 1203), the last-named being a minute species with four narrow leaves resting on the ground and a few small white flowers nestling at their centre. It was long ago placed in a genus *Saturnia* distinct from *Allium* and is not closely allied to these other species. They should be given a well-drained, sheltered and sunny



Floral details of *Allium*. a, *A. triquetrum* (sect. *Briseis*); b, *A. ursinum* (sect. *Ophioscorodon*); c, *A. Schoenoprasum* (sect. *Rhizirideum* or *Schoenoprasum*); d, *A. pulchellum*, Tubergen's var. (sect. *Codonoprasum* or *Macrospatha*); e, *A. Porrum* (sect. *Alliotypus* or *Porrum*); f, *A. cardiostemon* (sect. *Melanocrommyum*), after Nabel-ek; g, *A. albopilosum*, ovary in section (sect. *Melanocrommyum*); h, *A. Blomfieldianum*, ovary in section (sect. *Moly* or *Molium*). All X2.5.



Distribution of Allium Babingtonii

place in the rock-garden. *A. roseum* is a taller, foot-high species, with a round stem but glabrous leaves. The type has numerous deep pink flowers and is a diploid ($2n=16$, according to Messeri). More common in gardens is a variety with fewer flowers but numerous bulbils in the ovary, var. *bulbilliferum* (*Bot. Mag.* t. 978), and this, according to Messeri, is a tetraploid ($2n=48$).

Comparatively few of the numerous *Alliums* of Central Asia are now in cultivation, although many were introduced last century by Regel's explorer son Albert and were figured in *Gartenflora*. *A. karataviense* (*Bot. Mag.* t. 6451) is, however, well established. This species has broad, smooth, glaucous, reddish-margined leaves up to a foot long, 3 inches wide, and a large umbel, 3 or 4 inches in diameter, of pale pink flowers with reflexing segments, on a short stem about 6 inches high. Its most noteworthy features are its ornamental leaves and its large deeply indented capsules. It takes its name from the Kara Tau in north-western Turkistan. *A. albopilosum* (*Bot. Mag.* t. 7982) is a much more striking species. The leaves are broad, numerous and hairy. The

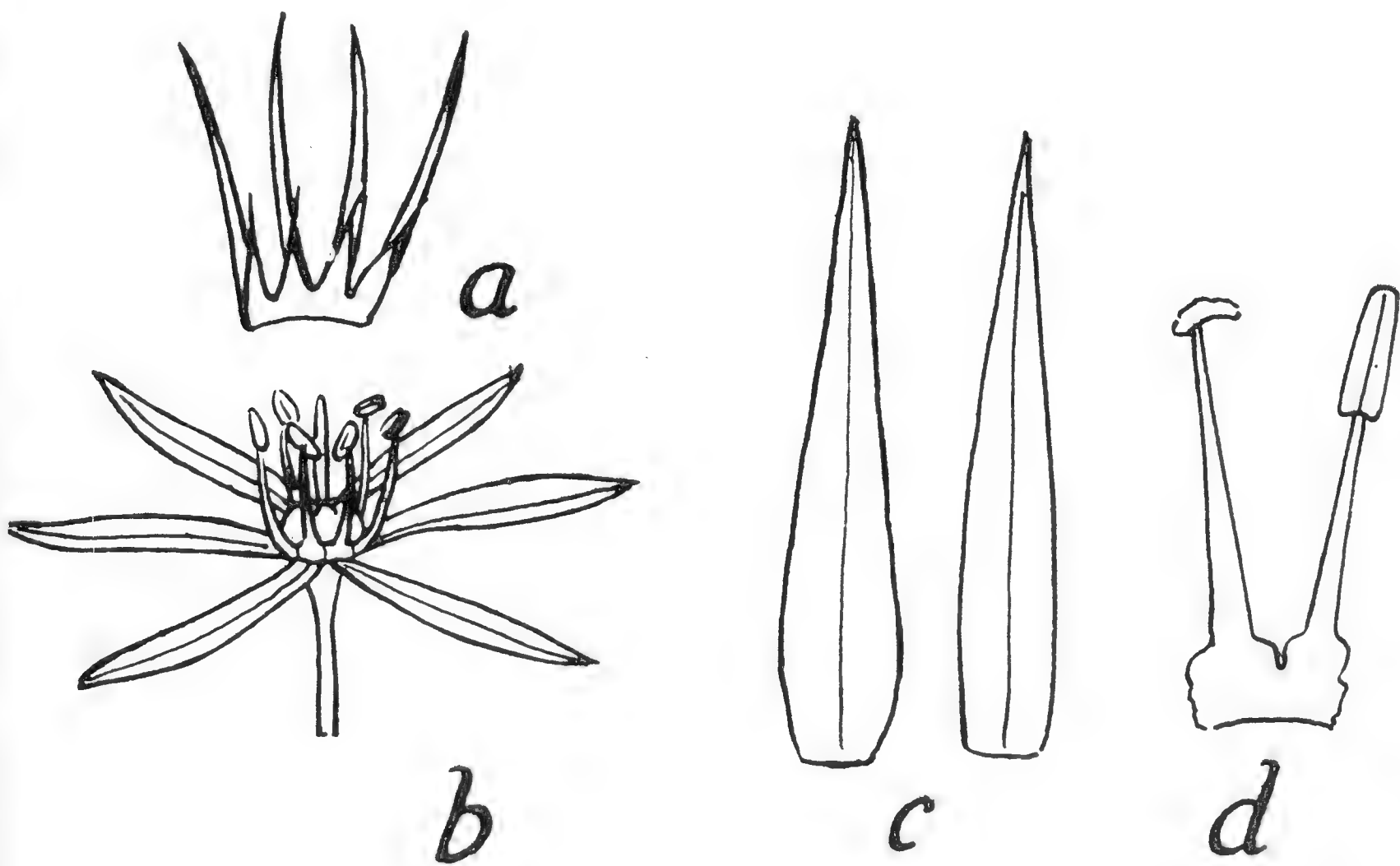


Figure 119. a, *Allium Christophi* (after Regel); b, *A. albopilosum* (after *Bot. Mag.*); c, perianth-segments, d, stamens (original).

flower-stem, usually more than a foot high, ends in an umbel, about 5 inches across, of very large starry flowers with long, glossy, lilac, narrowly lanceolate pointed segments (Fig. 119-b & c) which do not reflex but become stiff and woody after flowering. It is a native of the Turkmen mountains separating northeastern Persia from Transcaspia. This is also the type-region of *A. Christophi* (Figure 119-a) and Vvedensky unites the two, *A. Christophi* Trautv. (1884) having priority

over *A. albopilosum* C. H. Wright (1903). There is nothing in the original descriptions against this identification, but the filaments of *A. Christophi* as figured, probably incorrectly, in *Acta Horti Petrop.* 10 t. 7 (1889) do not agree with those of *A. albopilosum* as known from living material. (Figure 119-d). Confirmation of Vvedensky's conclusion is desirable.

In most *Alliums* there are only two ovules in each chamber (loculus) of the ovary. Around the Mediterranean, and particularly in the mountains and hills from Palestine and Syria eastward to the Caucasus and the Pamir-Alai region of Central Asia, grow a number of species with from three to ten ovules in each loculus (Plate 255 f & g); their leaves are fairly broad and part from the stem about ground-level. In habit they resemble the *Molium* *Alliums*. This group forms the section *Melanocrommyum*. *A. albopilosum* belongs to it, but the type-species is *A. nigrum* (*Bot. Mag.* t. 1148; *A. multibulbosum*), a robust plant with linear-lanceolate leaves up to 2½ inches wide and with stems 2 to 3 feet high carrying a many-flowered umbel about 3 inches across of large whitish or pink flowers; the perianth-segments are elliptic and the anthers yellow. *A. Cyrilli* is closely related but may be distinguished by its linear perianth-segments and purplish anthers. Both flower in June and seem to be fairly widespread in the Mediterranean region. *A. atropurpureum* (*A. nigrum* var. *atropurpureum*) has the general habit but is easily recognized by its extraordinarily dark reddish-purple, almost black, flowers; it is a native of Hungary and the Balkan Peninsula.

A. stipitatum is another tall species, the stem rising to about 3 feet and bearing a globose umbel, about 3 inches across, of small thin-textured pale lilac flowers with linear segments; pull these off and the papillose ovary will be seen to be narrowed at the base into a short stalk or stipe. The leaves, about four to a bulb, up to 13 inches long and 2 inches or so wide, are large, bluish-grey, strap-shaped and pubescent along the margin, and also on both sides towards the base, with short white hairs. *A. stipitatum* usually passes in gardens as *A. Rosenbachianum*, which, however, is a glabrous species. *A. giganteum* (*Bot. Mag.* tt. 6707, 6828) resembles *A. stipitatum* in habit but its leaves are glabrous and its lilac perianth-segments are elliptic. Too tall for the rock-garden, these species are excellent for growing in clumps in the herbaceous border.

Of species suitable for the rock-garden *A. oreophilum*, of which *A. Ostrowskianum* (*Bot. Mag.* t. 7756) is no more than a light-colored form, is as beautiful as any. It is a dwarf plant, with the stem about 4 to 8 inches high, carrying a flat umbel, 1½ to 2 inches across, of rather large wide-open triangular flowers. It possesses a remarkable distribution, being found in the northern Caucasus and also in the mountains of Central Asia. Like most species, all it needs is a sunny position in light well-drained soil.

Such a position suits admirably *A. flavum* (*Bot. Mag.* t. 1330), a graceful slender species with bluish stem and bluish smooth almost cylindrical but solid leaves; its small cup-shaped flowers are a soft yellow, with conspicuously protruding yellow anthers, on loose curving

pedicels. It grows about 9 inches high. *A. flavum* is a characteristic species of the section *Macrospatha* or *Codonoprasum*, in which the spathe is divided into two somewhat unequal valves, each with a long tail-like appendage. *A. carinatum* (Fig. 118, left), belonging to the same group, must be mentioned with a warning. Its reddish-purple flowers are all too few, and the bulbils which replace them are all too numerous, to justify its introduction. These bulbils ensure that it springs up where it isn't wanted. *A. pulchellum* is, on the contrary, of great garden merit. It can be regarded as a variety of *A. carinatum* without bulbils; actually, being a diploid, it is probably the species from which the triploid *A. carinatum* arose. There are two plants in cultivation under the name *A. pulchellum*, both with flat slightly ribbed leaves and reddish flowers with long protruding stamens, in a loose many-flowered bulbil-free umbel. Reference to the original description of *A. pulchellum* by George Don shows that his plant grew about a foot high, had dark anthers with yellowish pollen and produced seeds. These characters are shown by one of our cultivated plants. It grows about 1-1½ feet high and has deep red-purple flowers from July to August; it produces abundant seeds and the fruiting pedicels stand erect. This plant can accordingly be regarded as typical *A. pulchellum*. The other plant, which is even more attractive but less common in gardens, grows about 1½-2 feet high and has clear lilac (violet-rose) flowers (Plate 255-d) from August to September, rather later than the other plant; its anthers are yellow. It is either sterile or seeds rarely, and its bulbs increase rather slowly. This plant appears to have no official name; for the present it may be called "*A. pulchellum* van Tubergen's variety". The name *A. pulchellum* may possibly be superseded by an earlier name, either *A. cirrosum* Vandelli or *A. coloratum* Sprengel, if the precise application of these is ever established. For garden purposes *A. flavum* and the *A. pulchellum* forms are the best of the *Macrospatha* or *Codonoprasum* group. The other members of the group include many graceful plants, like *A. stamineum* and the perplexingly variable *A. paniculatum*, but beware of those which, like *A. oleraceum*, carry bulbils in the umbel.

Section *Porrum* or *Alliotypus* has more value in the kitchen—than in the flower-garden. Leek and garlic are its best-known members. It is easily recognized by the great difference in form between the outer and inner stamens. Whereas the outer three filaments are slender and subulate, the alternating inner three are broad and flattened, with the somewhat oblong basal part terminating in three appendages or cusps, of which the middle one carrying the anther is usually rather short while the two anther-less side cusps are often long and thread-like (Plate 255-e). The flowers in this section are usually rather small and ovoid or cup-shaped with erect segments often scabrid on the outside; they are crowded into dense heads. *A. sphaerocephalon* is probably the best for garden ornament. It grows about 1½ to 2½ feet high, has slender leaves sheathing the wiry stem for much of its height, and carries a dense rounded head of deep purple-red flowers in July and August. It has a wide distribution in Europe. *A. descendens* is an allied species

of south-eastern Europe. In Spain there occurs another close relative, *A. melananthum*, with purple-black flowers. *A. Babingtonii* (*A. Ampeloprasum* var. *Babingtonii*) may sometimes be met with in botanic gardens. It is best described as a perennial leek, with robust stems 4 to 6 feet high, having a few pale reddish flowers intermixed with numerous large bulbils. The distribution of *A. Babingtonii* is puzzling (Plate 256). It was first noticed in Cornwall, growing in or near old orchards, where it may have been a relict of former cultivation, and has since been recorded from Dorset in southern England, as well as from the counties Clare, Galway, Mayo and Donegal in western Ireland where it is now considered indigenous. It appears to be unknown outside the British Isles and decidedly Atlantic "oceanic" in range. Apart from its "architectural form" it has no garden value. The serpent garlic (*A. controversum*) belongs to the same group and has been recommended to the connoisseur of oddity for its complete and wayward irrelevance. Its "beak-shaped flower-heads writhe upwards in elaborate curves and coils, imitating a flamingo at its toilet and sometimes tying themselves in knots" and, as Jason Hill further remarks, "it is quite in character that this studied performance is a prelude to nothing in particular and that the flower-head, when at last it appears, discloses only a few onion flowers and a bunch of bulbils." This contortionist grows about 2 feet high. It is an old garden plant, being figured by Clusius in 1601 (Fig. 120) under the name *Scorodoprasum secundum*; *A. Ophioscordum*, if not identical, is at least very similar. The notorious crow garlic (*A. vineale*), most pestilential weed in the genus, also belongs to section *Porrum*. It produces bulbils in such abundance that its flowers are not so often seen. These bulbils may remain dormant in the soil for several years and its extirpation, once it has become established, is often extremely difficult.

A. caeruleum and *A. caesium* are blue-flowered species having the lanky, drum-stick habit of *A. sphaerocephalon* and are often grown in gardens. Their wiry stems, 1½ to 2 feet high, end in dense globose heads about 1½ inches across. To distinguish them, dissect a flower and look at the stamens. In *A. caeruleum* (*Bot. Reg.* 26. t. 51; *A. azureum*) all the stamens are simple and undivided; in *A. caesium* the inner three filaments are much broader towards the base than the outer three and have two tooth-like appendages. Both species are widely distributed in the steppes and deserts of Central Asia, and a warm, dry place in the rock-garden suits them well.

These are not the only blue-flowered *Alliums*. In the mountains extending from Sikkim eastward to central and north China occurs a group of low-growing species with blue flowers and narrow, clustered, rhizomatous bulbs. *A. cyaneum* (*Bot. Mag.* t. 9483) from north China has clusters of little cup-shaped purplish-blue or pale heliotrope flowers, with long protruding stamens, on stems about 6 inches high, and makes close tufts of thread-like leaves. The others have broader, linear leaves and their stamens are shorter than the perianth. In *A. kansuense* (*Bot.*

Mag. t. 7290) and *A. sikkimense* (*Bot. Mag.* t. 8858) the leaves are almost basal and the flowers are about 9 mm. long. In *A. Beesianum* (*Bot. Mag.* t. 9331) the leaves sheathe the foot-high stem for a third or more of its length and the pendulous China-blue flowers are about 14 mm. long.

Scorodoprasum II.

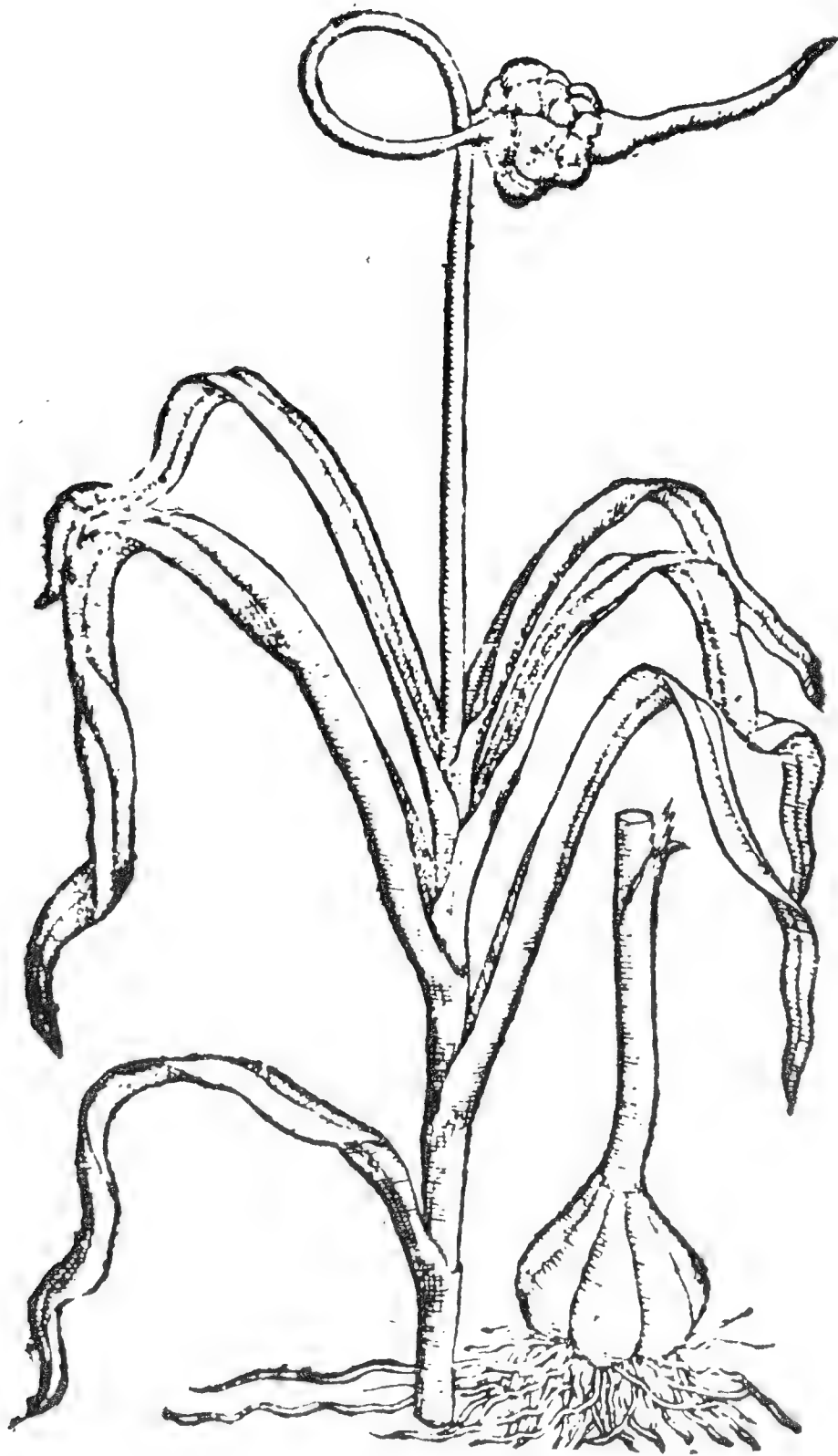


Figure 120. *Allium controversum* Schrader *Scorodoprasum secundum* Clus. From *Clusius Rariorum Plantarum Historia* (1601).

China yields many other beautiful species of *Allium* belonging to the same section as these "blue-bell garlies". *A. Mairei* (*A. yunnanense*), about 4 to 8 inches in height, by its narrow almost thread-like leaves recalls *A. cyaneum*, but its small narrowly bell-shaped flowers stand almost erect and are pale pink or white dotted with pink. It blooms in August and September. *A. amabile* (*Bot. Mag.* t. 9257),

which is probably not specifically distinct from *A. pyrrhorrhizum*, resembles *A. Mairei* closely but possesses flowers of rich magenta-crimson. *A. Farreri* is rather more robust. It was long known in English gardens as “*A. sp. Tibet*,” a designation which became converted into *A. tibeticum*. There exists, however, an *A. tibeticum* described by Rendle in 1906, a blue-flowered plant related to *A. sikkimense* and unconnected with this reddish-purple one, which could not be identified with any of the species known from India and China. Luckily one enthusiast, the late Reginald Cory, grew it as “Farrer 165” and comparison with a specimen in the Edinburgh herbarium under the same number proved that it had indeed been introduced by Reginald Farrer (1880-1920) from the neighborhood of Siku, Kansu, in northwestern China. It is an attractive species, with grassy leaves or sprawling angled stems 6 to 12 inches or so high, carrying a loose umbel of tubular-campanulate purplish flowers about 8 mm. long. The stamens are fused into a tube around the ovary and the pedicels are rough with minute teeth. By these features it is easily recognized. The narrow bulbs are closely clustered and joined by a short rhizome.

Section *Rhizirideum* is typified by the *A. senescens* group. (Plate 255-c). It consists of plants with fairly stout, woody, Iris-like rhizomes, whence Don's name *Rhizirideum* and Salisbury's *Xylorhiza*; the leaves are basal, more or less erect, flat, *Narcissus*-like, often glaucous and twisted, and out between them rise two-edged stems carrying many-flowered hemispherical heads of pink or purplish, more rarely white or yellowish flowers. To recognize the group is easy; to distinguish the species is another matter. *A. nutans* (*Bot. Mag.* t. 1143) is the most robust. It often grows as much as 2 feet high. The inner stamens are twice as broad as the outer three and have normally a tooth on each side at base. *A. senescens* is dwarfer; the inner stamens are scarcely broader than the outer and lack basal teeth. The leaves are smooth and rounded beneath, with no prominent mid-rib. A multitude of different-looking plants, all answering to this general description, may be found in gardens. They differ among themselves in height, in the width, twistedness and color of their leaves, and in shade of flower-color, but they defy classification into well-defined varieties, so much have they intermingled under cultivation. The identification of wild material is less difficult. To this group belong the names *A. baicalense*, *A. fallax*, *A. glaucum*, *A. serotinum*, *A. spirale* and *A. spurium*. Its geographical area falls into two parts:—the Asiatic, which extends from the Tarbagatai region of the U. S. S. R. to Manchuria, i. e. probably not west of 80° E; and the European, which extends from Portugal, Spain and Sicily to the Volga-Don region of the U. S. S. R., i. e. probably not east of 40° E. The European form (*A. montanum* F. W. Schmidt) has much narrower leaves than the robust Siberian form figured by Gmelin (*Fl. Sib.* 1. t. 11:1747) which is usually regarded as the type of *A. senescens*. The gap of 40 degrees of longitude which separates them is a further argument for considering them specifically distinct. In nature *A. montanum* grows under dry conditions, on stony well-drained slopes, as I have ob-

served in the type-region, Bohemia. The related *A. angulosum*, which may be distinguished by the prominent mid-rib on the underside of the leaf, prefers moist conditions—I have seen it in quite damp meadows in the Rhineland—and is rarely cultivated.

The *A. senescens* group lacks richness of color but this is not a defect showed by all the *Rhizirideum* Alliums, certainly not by *A. narcissiflorum* (*Bot. Mag.* t. 6182; *A. pedemontanum*, *A. grandiflorum*). This species is among the most beautiful of the genus and was Reginald Farrer's favorite. In his *English Rock Garden* he described it with his characteristic enthusiasm. "In places more august" than those chosen by *A. Schoenoprasum* var. *Hegetschweileri* "dwells *A. narcissiflorum*, in the steep earth-pans and stony screes high up in the most awesome shelves of the limestone Alps of Piedmont * * * Here it runs underground, forming a huge ramifying mass of rootstocks below in the un-negotiable stony hard earth, and the surface of that barren place is covered with a waving green jungle of upstanding strap-shaped leaves, up among which come shooting, in August, springy stems of 8 or 10 inches, each hanging out a loose head of some six or eight flowers, very large and lovely indeed, great pendent bells of glowing vinous red". It is quite easy to cultivate on a ledge of the rock-garden. *A. insubricum*, from the Alps of Lombardy, is a closely allied plant.

Chinese chives or kiu ts'ai (*A. tuberosum*) has already been mentioned as a salad-plant of Chinese and Japanese kitchen-gardens. It is often called *A. odorum*, the flowers being pleasantly scented unless bruised. The true *A. odorum* (*Bot. Mag.* t. 1142), for which the correct name is *A. ramosum*, blooms earlier (from June to July instead of from August to October) than *A. tuberosum* and has larger almost bell-shaped flowers, with the stamens about half as long (not almost as long) as the segments. Out of flower the two may be distinguished by their leaves, solid in *A. tuberosum*, hollow towards the base in *A. ramosum*.

Nectaroscordum siculum (*Bot. Reg.* 22. t. 1912; *A. siculum*) may with almost equal propriety be included in the genus *Allium* or excluded from it as the type of an allied genus. It grows about 3 feet high and has comparatively large, thick-textured, bell-shaped flowers colored dull green, purplish pink and buff, on curved pedicels which become erect as the capsules mature, the perianth-segments then becoming dry and cartilaginous. The tip of the pedicel is swollen into a broad disc, in which the ovary is, as it were, sunk, its broad shallowly conical top rising little above the point of insertion of the perianth-segments. There are numerous ovules in each chamber of the ovary. It is a graceful species but not one to be handled; it gives out when bruised a most powerful nauseating vile stench reminiscent of a bad drain or a gas-escape. *N. siculum* is a native of Sicily, Sardinia, Corsica, Italy and Provence. An allied form with whitish flowers, *N. bulgaricum* (*A. bulgaricum*), occurs in the Balkan Peninsula.

There are many other Alliums worthy of cultivation besides those mentioned above. They are only a selection of Old World species and include by no means all that may be encountered in botanical gardens

or that have been introduced into cultivation and subsequently lost, leaving their portraits in Curtis's *Botanical Magazine* and Regel's *Gartenflora*. The American species are less numerous but no less interesting; to discuss them here would occupy too much space. The *Allieae* include no flamboyant beauties; those, however, who like their flowers small and delicate —“the taste of all gardeners”, observes Miss Sackville-West, “as their discrimination increases, dwindles toward the microscopic”—will find the group one of almost inexhaustible interest.

HERBERT MEDALIST, 1944

In recognition of his outstanding contributions in the field of onion breeding, the William Herbert Medal for 1944 has been awarded to Dr. Henry A. Jones, Principal Olericulturist, Bureau of Plant Industry, Agricultural Research Administration, United States Department of Agriculture. An excellent portrait of Dr. Jones is presented in Plate 254.

HERBERTIA, VOLUME 11 (1944)

The demand for this volume of *Herbertia*, the most outstanding up to the present, and published in a limited edition, will not diminish in the future. Members are requested to preserve their copies with the greatest care so that copies may later be available for library, and other special needs.

HENRY ALBERT JONES

AN AUTOBIOGRAPHY₁

When I was a small boy my father rented a 40-acre market garden near Ottawa, Illinois, and grew small fruits and vegetables, mostly onion sets and asparagus, to be sold on the local markets or shipped to Chicago. I attended school in Ottawa then, but not very regularly because I spent a good deal of my time cutting and packing asparagus; picking berries, beans, peas; and sorting onion sets. We harvested onion sets in late summer or early fall, stored them throughout the winter, and sold them to the Chicago wholesalers the following spring. My big fall and winter job was removing sprouted and rotted onions from the shallow storage trays. This seems somewhat significant now, but I am sure that as a young boy, sorting onions until my fingers were numb and my feet cold, I had no desire at all to become an onion fancier.

In December, 1901, when I was 12 years old, my family moved to Seward, Nebraska. There we grew nearly all the locally important vegetable crops in a small market garden along the Blue River and sold them to the Seward markets. My father died in 1905. During the next 4 years I stayed with mother while she operated the market garden. I found it very fascinating to grow an assortment of vegetables, but huckstering from door to door did not interest me at all. In two of those four years disastrous July floods destroyed all our crops. These reverses were probably blessings in disguise to me, because they rather encouraged me to continue my education, which had been greatly neglected up to that time.

In the fall of 1909 I entered the School of Agriculture at Lincoln, Nebraska, and was graduated in the spring of 1912. That same fall I matriculated at the University of Nebraska's College of Agriculture and in March 1916 completed the required course of study with majors in botany and plant pathology. In June of that year I was married to Louise Frances White, and in the following October I began graduate study for a doctorate at the University of Chicago, with a major in plant physiology. I completed this work in August 1918.

My first job after graduation—another onion undertaking—was a temporary one with the United States Department of Agriculture's Bureau of Markets studying onion storage in the Connecticut Valley of Massachusetts. An opening in the Department of Horticulture at the University of West Virginia in Morgantown tempted me, and I began work there in January 1919. In June 1920 we moved to the University of Maryland in College Park, where my time was occupied in teaching and research in vegetable crops. In the summer of 1922 I was invited to take charge of the Division of Truck Crops, University of California, at Davis, and I started work there the following October. I spent 14 years in California, and they were most interesting years filled with rich experiences.

¹ Born Deer Park, Illinois, May 6, 1889; B. S. A., University of Nebraska, 1916; Ph. D., University of Chicago, 1918.

I left California, with my wife and four children, in 1936 to take charge of the United States Department of Agriculture's potato and onion investigations, with headquarters at the Plant Industry Station near Beltsville, Maryland. Though we were all reluctant to leave California, I felt that the Beltsville Research Center was destined to become one of the world's outstanding agricultural research centers, and I welcomed the opportunity to cast in my lot with this rapidly developing institution. My years at this Station also have been rich in experiences and associations, and my work on the development of hybrid onions—begun in California and continued here—has certainly been a most fascinating and satisfying undertaking. I am indeed glad that those numb fingers and cold feet in boyhood did not forever keep me away from onions.

AMARYLLID NOTES FROM SOUTH AFRICA

K. C. STANFORD, *South Africa*

The writer has heard from Mr. Frank McCoy about the "Giant White" *Agapanthus* (described elsewhere in this issue). The writer does not know how it happened as hers look near alike, but of course these were not grown from seeds. However, the writer now has some that were purchased as special hybrids that are "lightly" shaded blue or pink, but it must be said that this is very "lightly". Their blossoms are big and appreciably distinct and for that reason the writer is going to save seeds when they flower again.

The writer has a huge lot of *Agapanthus pendulus* grown from seeds furnished by the National Botanical Gardens at Kirstenbosch. They are very mixed and it will take years to sort them out. The true form is a "Navy Blue" on a five foot scape. There is also the dwarf, dark coloured mountain variety which is very attractive, but is apt to grow tall as the type under garden conditions.

The writer is working up a collection of *Alstroemeria* species. They do well here when given shade and ample water. Our rich acid soil is near ideal for their culture, and since they flower later than most of our bulbous plants they are in demand as a cut flower.

The publication of a book on South African flowers has been announced. The author knows quite a bit about them and he is an excellent photographer. It is to be sold for Red Cross funds. The present writer has also started on a similar book, but it will take a year or more to complete it.

AMARYLLID MUSINGS

W. M. JAMES, *California*

For the first time in three years I was able to leave Ojai for a few days this summer. A short visit with Dr. Traub was very enjoyable. It was a pleasure to meet Mr. Hannibal for the first time. He is very energetic and is growing many varieties of Amaryllids. It was between seasons and most of his plants were dormant, but I enjoyed "compar-

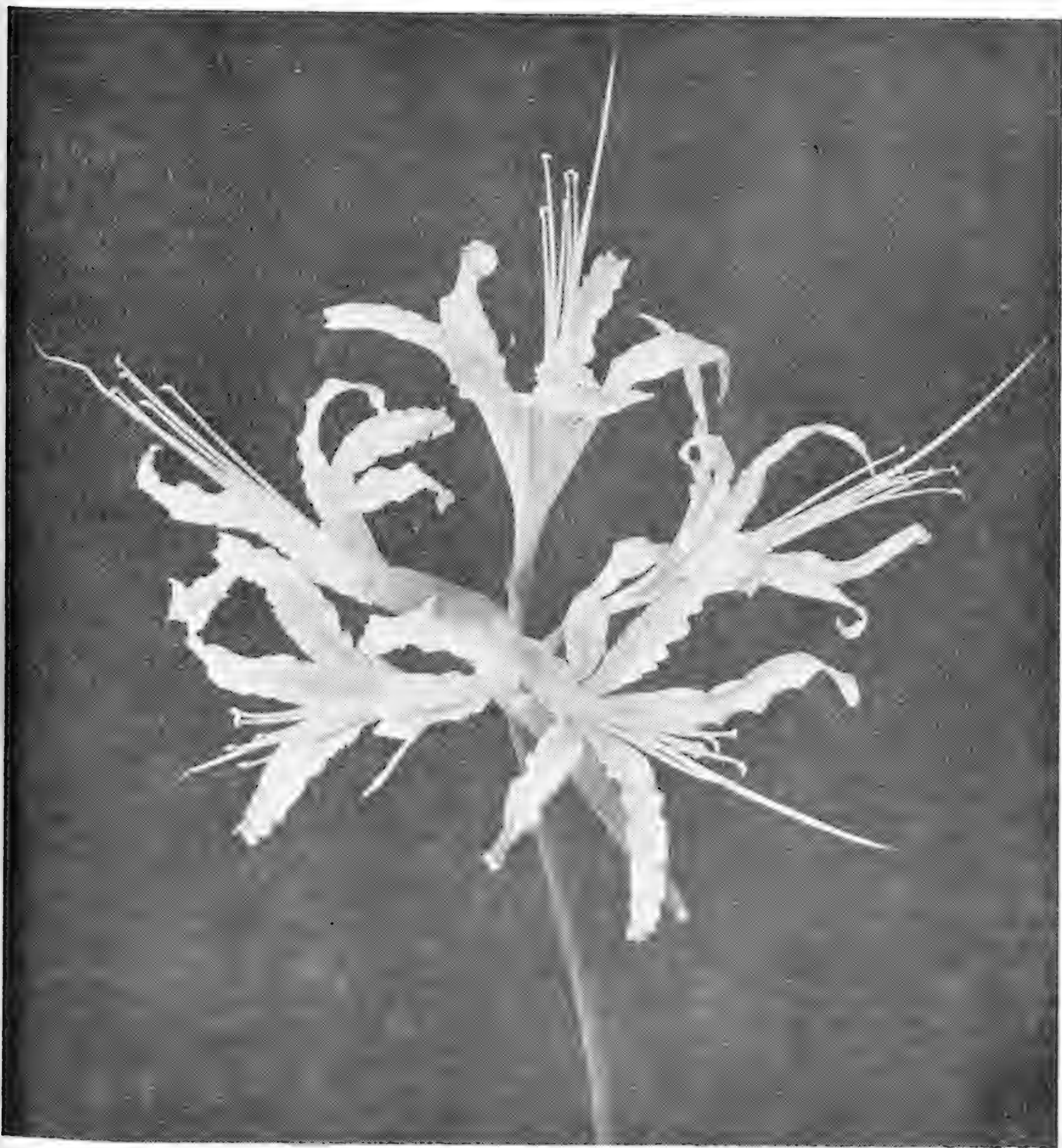


Figure 121. *Lycoris aurea*. Photo by W. M. James.

ing notes" with him. At Mr. Brown's near Gilroy, I saw a few good off-season blooms of white amaryllis. These flowers, and a collection of colored transparencies, indicate that he has a very fine strain. Mr. Brown spent several years in Rhodesia and is very interesting to visit and talk with.

The *Worsleya procera* (Plate 257) bloomed very nicely at Las Positas Nursery again this year. Some of the plants which bloomed this season were marked as having bloomed last season also. There is quite a variation in color and size of flower. Some are bluer than others. The plants look vigorous and healthy and apparently like their position in partial shade in a slightly raised bed composed solely of decomposed granite. Seedlings are proving difficult, although the seed germinates readily.

The nerines at El Rancho Rinconada did very well this year especially those with summer foliage.

Nerine Masoniorum and *N. filifolia* flower stems were about as thick as grass. (Plate 257a). Apparently they like the warm summers we have here. *Nerine Hera* is doing much better than it did at Santa Barbara (Plates 258).

I am beginning to think that the secret of success with *Alstromerias* in Southern California is to keep them from starting too early in the fall. The warm summers seem to ripen the tubers so thoroughly that it takes very little water to start foliage growing in September. I have never seen these early stems produce flowers—only those which start after colder weather and which make most of their growth in the spring. It is so warm in the fall that the only way I know of to keep them from starting is to withhold all water. This will not be easy on smaller places, but if a corner can be given them and kept completely dry from ripening time in the late spring until about November, good results are quite certain.

A bulb of *Lycoris aurea* belonging to Dr. Traub bloomed this fall (Figure 121). This plant is not new at all in Southern California, but it is so seldom seen that it is almost a curiosity. In Santa Barbara it is very short lived, possibly because of the cool summers. I hope it will do better in the warmer climate of Ojai.

Temperature is apparently quite a factor in seed setting on the white hybrids of *Brunsvigia rosea*. At Las Positas Nursery I had difficulty in getting seed even with careful hand pollination. At El Rancho Rinconada many of the white flowers and almost all of the pink forms set seed without any hand pollination. Bumble bees were probably responsible for the pollination. These seedlings take three to five years to bloom and those at Las Positas Nursery so far have not had a high percentage of whites—mostly a wide variation from very dark pink to near white. Next year I hope to have time to start a thorough test of the correlation between seed and flower color, as outlined by Mr. E. O. Orpet on pages 124-126 in Vol. 10 of *Herbertia*. Pink forms are in such supply that there is no use in growing seedlings of that color if it can be avoided.



Worsleya procera in bloom at Las Posas Nursery, Santa Barbara, Plate 257
Calif., 1944. Photo by W. M. James

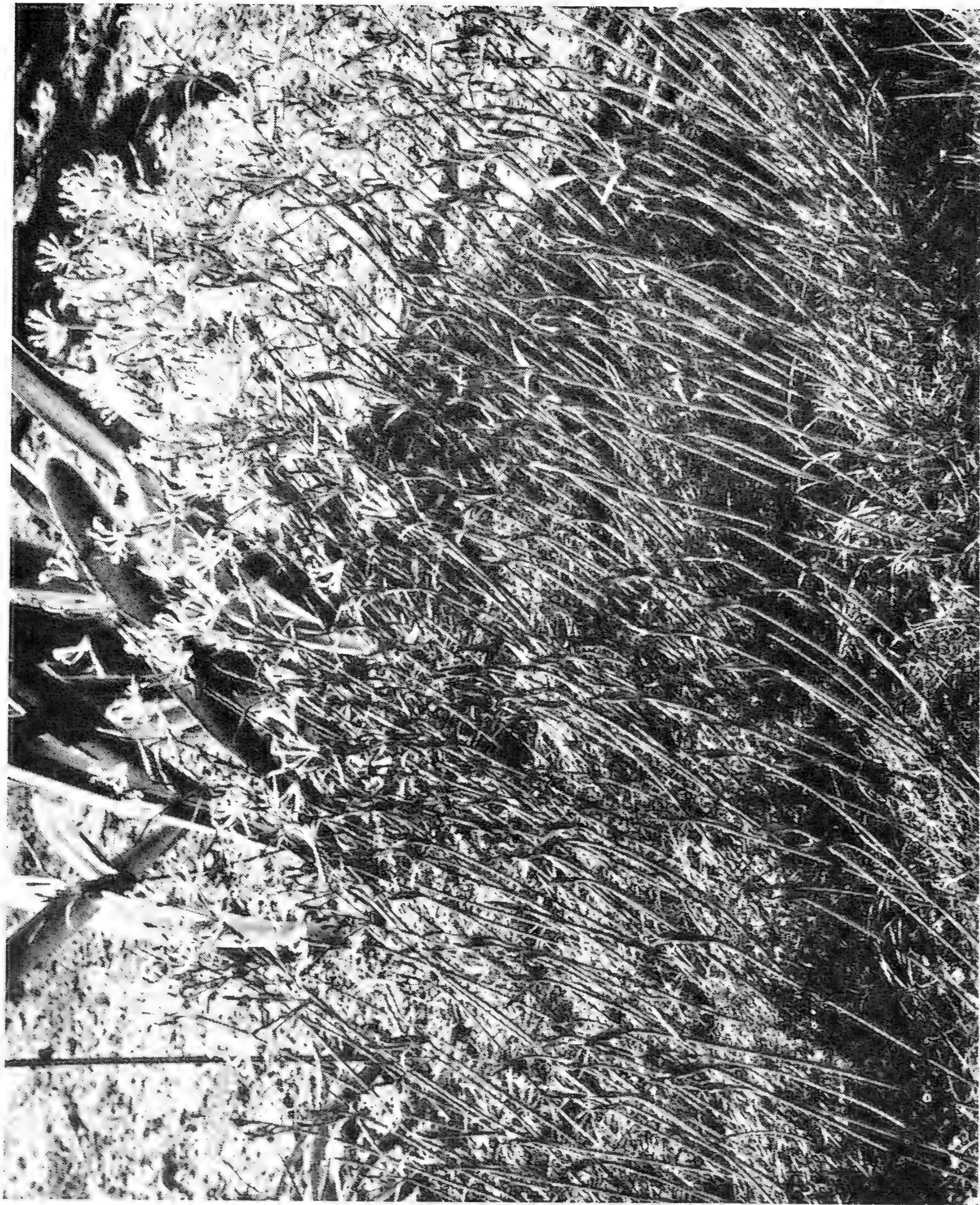


Plate 257a

Nerine filifolia
Photo by W. M. James



Nerine Hera
Photo by W. M. James

As I write this, war conditions both in Europe and the Pacific look more favorable, indicating that the time is not too far distant when some of our boys will be coming home and that we can again resume some of the activities which have had to be curtailed or postponed for a time.

CAIN'S "FOUNDATIONS OF PLANT GEOGRAPHY"¹

HAMILTON P. TRAUB, *California*

This is undoubtedly the first important book in this field and is indispensable to the modern worker in plant systematics.

In order to orient the reader, "in a field that seems naturally to be diverse and ramifying", the author presents, in Part I, a brief outline of thirteen previously proposed principles of plant geography, primarily from the works of Good and Mason. In the remaining portion of the book, according to the author, "Some of principles will not receive more than incidental consideration This is especially true of those that belong more in the province of physiological plant geography. Others, those having primarily chronological significance, will be dealt with in some detail. Some of the principles of Good and Mason are reworded and elaborated and additional ones are added as the subject is developed." This is the modest claim of the author. The reader will note, after he has finished reading the book that Prof. Cain has actually accomplished much more than that for he has given us a comprehensive viewpoint of the science of plant geography that had a rather vague meaning to many workers in plant science. In subjecting a large number of research papers, in the field under consideration, to keen critical review it has been possible for him to outline a sound basis for plant geography.

Parts II to V, inclusive, of the book are devoted to paleoecology, areography, evolution and plant geography, and the significance of polyploidy in plant geography.

One of the outstanding qualities of the book consists of the rigid insistence on the scientific method of approach. In referring to the sciences of geobotany, plant geography, plant ecology and plant sociology, the author remarks, "What is most needed in these fields is a complete return to inductive reasoning, with assumptions reduced to a minimum and hypotheses based upon demonstrable facts and proposed only when necessary."

With reference to the selection of the material included in the book, each specialist will undoubtedly notice, what seems to him, important omissions. This, however, is a vast field, and Prof. Cain is to be congratulated for making his treatise as comprehensive as it is in this first edition of a work that will be essential for an indefinite period.

¹ Cain, Foundations of Plant Georgraphy, Harper & Brothers, 49 East 33rd. St., New York. 1944. \$5.00

1. REGIONAL ACTIVITY AND EXHIBITIONS

AMARYLLIDS AS AN EDUCATIONAL TOOL

R. G. HUEY, *Superintendent*
Paintsville (Kentucky) Public Schools

An appreciation of the beautiful in nature should and can be the heritage of every child. Upon this philosophy rest the attempts made in the Paintsville Public Schools to interest its pupils in the study and cultivation of amaryllids.

The ability to recognize and enjoy a beautiful plant or flower is a priceless possession. Neither adversity nor misfortune can take it away. Once acquired, it is a permanent part of life. It is a personal retreat where one may momentarily withdraw from the routine problems and cares of every day toil to relax in peace and refreshing enjoyment.

Our interest in amaryllids began with a very fine clone of Hybrid *Amaryllis* received some years ago along with a shipment of dahlias from India. To this was added additional stock from some of the best American and English sources. The Botany Department became interested and began to make some crosses and to propagate. Seedlings from some of these first crosses have flowered during the present year. As the study continued and the interest grew, other amaryllids have been added to the collection, which now includes various forms of *Crinum*, *Clivia*, *Lycoris*, *Nerine*, *Vallota*, *Brunsvigia*, *Haemanthus*, *Zephyranthes*, *Stenomesson*, *Amarcrinum*, *Sprekelia*, and *Habranthus*. We hope to add others as rapidly as possible.

The cultivation, care, breeding and propagating is carried on by the students in the Botany Department under the guidance of instructors and affords valuable practical experience in the class room. Out of the work and study of the various amaryllids has come a greatly increased interest in the geography of the native lands of these plants, and, as a result of the geographical study, a better understanding of the people of these countries. Considerable correspondence has been carried on with students in other lands. Former students in this school, now in the armed services, are writing from the various lands where they are now located and telling of the various amaryllids they have run across.

The school is becoming amaryllid conscious. Each of the thirty home rooms grows and flowers in its windows during the school year one or more forms. Many of the pupils are growing them in their homes. We believe they will become better and happier men and women from having done so.

AMARYLLIDS IN THE SAN FRANCISCO PUBLIC SCHOOLS

[The following letter from Mr. Harry E. Nelson is of interest in connection with the amaryllid projects in our public schools.—*Ed.*]

VICTORY GARDEN ADVISORY COUNCIL

an activity of the

SAN FRANCISCO CIVILIAN WAR COUNCIL

San Francisco 12

San Francisco Junior College,
Ocean and Phelan Avenues,
October 24, 1944

Dear Mr. Traub:

Your letter of October 18th. is at hand and in reply Mr. Silva and I wish to say that we feel that we have little to write about at this time.

Last spring a Victory Gardening program was started in the elementary and junior high school through the auspices of the Civilian War Council. It proved very helpful and did a great deal of good, especially in the way of therapy. It was continued through the summer and we recognized it again this fall. Some of the schools are having such good results that they wish to make gardening a regular portion of their curriculum.

The Board of Education has decided to take two of the school programs under its wing if we will keep the teachers supplied with information, and if we will make regular calls to supervise the program. This is a great satisfaction because I feel that we will probably keep a certain type of youngster in school longer if he has a gardening activity to keep him busy. Then, too, there is a possibility that we will get some of these youngsters after a period of time in my floriculture classes. At any rate I have a great deal of enthusiasm for the program and feel very happy that they will give us the opportunity of trying it on the students.

Mr. Silva and I became very much interested in the amaryllids a few months ago and were trying to reach some decision as to what genera we should work with. We were agreed that the Amaryllis family offered great possibilities and we both liked the species with which we were familiar. Mr. Silva is interested in the Nerines, and my chief interest is in the Bomareas.

We felt that we could do a great deal of good work during our spare time if we had something of the sort to work with and so we took a trip up to see Mr. Hannibal. He overwhelmed us with a tremendous collection of rare as well as the more common kinds. We brought them home and we then reviewed the whole situation.

[AMARYLLIDS; SAN FRANCISCO SCHOOLS, continued on page 274.]

2. DESCRIPTION, CLASSIFICATION AND PHYLOGENY

THE FLORISTIC REGIONS OF THE U. S. S. R. WITH REFERENCE TO THE GENUS *ALLIUM*

WILLIAM T. STEARN

1. *Geographical Divisions adopted in the "Flora URSS"*

The Union of Soviet Socialist Republics inherits the original East European homeland of the Russian people and the vast Asiatic empire which they conquered and colonized in the Tsarist times. This area of more than 8,170,000 square miles opens to the west upon the Black Sea, the Baltic Sea and the White Sea, to the east upon the Pacific Ocean. Between the Arctic Ocean, which bounds the Union in the north, and the long chains of high mountains which lie along most of its southern frontier, there stretch wide zones of tundra with permanently frozen subsoil, of coniferous, mixed and deciduous forest, of marsh, steppe and desert. Russia's soils range from the peat of the tundra, the grey soil of the forest and the very fertile black soil of the southwestern plains to the barren red and yellow sands of the deserts and the rocky scree of the mountains. The Union includes cold dry regions and hot dry regions and regions of heavy rainfall, arctic regions and subtropical regions, and it thus offers to plants a great variety of climatic and edaphic conditions. During the Ice-Ages much of its Tertiary vegetation must have been swept away, for even though, at the maximum extension of the ice, probably less than half of the whole area was covered by ice-sheets, these tended to surround the central ice-free land with belts of high barometric pressure and to subject this area to a very severe continental climate. The Union borders on regions both in the southeast and southwest where rich floras survived, and from these the ice-devastated areas were recolonized. In their new homes, particularly in the mountains of Central Asia (the Pamir-Alai and Tien Shan regions), the colonist populations broke up into a number of new species. The flora of the Soviet Union is accordingly a rich and varied one, including many endemics, i. e. species which do not extend beyond its borders. Ledebour's *Flora Rossica*, published between 1841 and 1853, enumerates nearly 6,600 species of flowering plants and vascular cryptogams, among them 65 species of *Allium*, but in his day the Khanates of Bukhara, Khive and Khokand in Central Asia were still unconquered; Western Turkistan, floristically the richest part of the Soviet Union, had not been added to the Russian Empire. The flora of the Union is now estimated to consist of between 15,000 and 20,000 species, among them 225 species of *Allium*.

For the purpose of the *Flora URSS*, edited by V. L. Komarov for the Academy of Science of the U. S. S. R. (Leningrad, 1934 *et seq.*), which aims at classifying and describing all the flowering plants and vascular cryptogams of the Soviet Union and at stating concisely their distribution, the territory of the Union has been divided into seven

parts (chasti):—the *Arctic* part, extending from Kela Peninsula in Lapland to the Bering Strait; the *European* part, extending south of the Arctic to the Black Sea, the Caucasus and the Caspian Sea; the *Caucasus*; *Western Siberia*, including the Soviet Altai; *Eastern Siberia*; the *Far Eastern* part from the foot of the Kamchatka Peninsula south to Vladivostok; *Central Asia*, corresponding to the Russian (or western) Turkistan of the Tsarist Empire.

These seven parts (chasti) are again divided, making forty-nine regions (rayony) in all. This is not an excessive number for so vast a territory, and some of them, notably the Siberian regions, might usefully have been split into much smaller areas. Only a few of these floristic divisions coincide in name and boundaries with past or present administrative areas. They are not mapped in any atlas or defined in any accessible work. Their approximate boundaries can, however, be deduced from occasional statements in the text of the *Flora URSS* and the sketch-map in vol. 1 facing p. xvi (1934) which is, unfortunately, on a very small scale, without much detail. It is to be hoped that in the final volume of the *Flora* this will be supplemented by a number of more detailed maps on a larger scale. The *Flora* summarizes the distribution of plants in terms of the abbreviated regional names used on this map. Hence without the map its statements of distribution are meaningless. Plate 259 is a copy of this map on a yet smaller scale, with Arabic numbers substituted for the abbreviated names of the original; indications of the courses of rivers and the boundaries of republics have been reluctantly omitted. The numbers are those under which the regions are listed in the *Flora URSS* 1. 13 (1934) where an explanation is given of the abbreviations employed on the map and in the text. The numbers themselves do not appear elsewhere in the *Flora*, but they have been added to the translation of Vvedensky's account of *Allium* in the Soviet Union (*Herbertia* 11:65-218. 1944).

The floristic regions of the Soviet Union are based on major topographic features such as the courses and basins of rivers and groups of mountains. They take most of their names from such rivers and mountains, thus resembling the Departments of France. The rivers include the Amu Darya, Anadyr, Angara, Bureya, Dnieper, Don, Dvina, Trtysh, Kama, Kolyina, Lena, Ob, Pechora, Syr Darya, Tobel, Ussuri, Volga, Yenisei and Zeya. The mountain regions include the Caucasus, Pamir, Alai, Tien Shan, Altai and Tarbagatai. Lakes Balkhash, Ilmen and Ladoga, the Black, Aral and Caspian Seas and the deserts Kyzyl Kum and Kara Kum have given names to others, and in a few instances existing regional names have been retained, notably for sea-girt areas, like the Crimea, Kamchatka, Novaya Zembla and Sakhalin.

In List No. 1, are listed the "parts" and "regions" recognized in the *Flora URSS*. Each region is preceded by the number under which it is shown on Plate 259 and listed in the *Flora URSS* 1. 13 (1934); then follows the Cyrillic abbreviation used in the text of the *Flora* and a transliteration of the full Russian name.

LIST NO. 1

A. The “parts” and “regions” recognized in the *Flora URSS*. Each region is preceded by the number under which it is shown on Plate 259 and listed in the *Flora URSS* 1. 13 (1934); then follows the Cyrillic abbreviation used in the text of the *Flora* and the transliteration of the full Russian name.

I. ARCTIC (АРКТ.; Arktika)

1. Arctic Europe (Аркт Евр.; Arktichesky poyas Evr. chasti S. S. S. R.)
2. Novaya Zemlya (Н. Зем.; Novo-Zemel'sky rayon)
3. Arctic Siberia (Аркт. Сиб.; Arktichesky poyas Sibiri)
4. Chukotsk (чук.; Chukotsky rayon)
5. Anadyr (Анад.; Anadyrsky)

II. EUROPE (ЕВРОП. Ч.; Evropeyskaya chast')

6. Karelian Lapland (Кар.-Лappl.; Karelo-Laplandsky rayon)
7. Dvina-Pechora (Дв.-Печ.; Dvinsko-Pechersky)
8. Ladoga-Ilmen (Лад.-Ильм.; Ladoga-Il'mensky)
9. Upper Volga (Верх.-Волж.; Verkhne-Volzhsky)
10. Volga-Kama (Волж.-Кам.; Volzhsky-Kamsky)
11. Upper Dnieper (Верх.-Днепр.; Verkhne-Dneprovsky)
12. Middle Dnieper (Сред.-Днепр.; Sredne-Dneprovsky)
13. Volga-Don (Волж.-Дон.; Volzhske-Donskoy)
14. Transvolga (Заволж.; Zavolzhsky)
15. Bessarabia (Бесс.; Bessarabsky)
16. Black Sea (Причерн.; Prichernomorsky)
17. Crimea (Крым; Krym)
18. Lower Don (Ниж.-Дон.; Nizhne-Donskoy)
19. Lower Volga (Ниж.-Волж.; Nizhne-Volzhsky)
- 19a. Ural [Урал; Ural (khrebet)]

III. CAUCASUS (КАВКАЗ; Kavkaz)

20. Ciscaucasia (Предкавк.; Predkavkazsky rayon)
21. Dagestan (Дар.; Dagestansky)
22. West Transcaucasia (Зап.-Закавк.; Zapadno-Zakavazsky)
23. East Transcaucasia (Вост. Закавк.; Vostochno-Zakavkazsky)
24. South Transcaucasia (Юж.-Закавк.; Yuzhno-Zakavkazsky)
25. Talysh (Тал; Talyshsky)

IV. WESTERN SIBERIA (ЗАП. СИБИРЬ; Zapadnaya Sibir')

26. Ob¹ (Обск.; Obsky rayon)
27. Upper Tobol (Верх.-Тоб.; Verkhne-Tobol'sky)

¹The Ob region extends from the eastern slope of the Urals to the Yenisei river but does not include the eastern tributaries of the Yenisei, i.e., the lower Tunguska and the Middle Tunguska, which are in the Yenisei region.

- 28. Irtysh (Ирт.; Irtyshsky)
- 29. Altai² (Алт.; Altaisky)

V. EASTERN SIBERIA (ВОСТ. СИБИРЬ; Vostochnaya Sibir')

- 30. Yenisei (Енис.; Yeniseysky rayon)
- 31. Lena-Kolyma (Лен.-Кол.; Leno-Kolymsky)
- 32. Angara-Sayan (Анг.-Саян.; Angaro-Sayansky)
- 33. Dauria (Даур.; Daursky)

VI. FAR EAST (ДАЛЬН. ВОСТОК; Dal'ny Vostok)

- 34. Kamchatka (Камч.; Kamchatka)
- 35. Okhotsk (Охот.; Okhotsky rayon)
- 36. Zeya-Bureya (Зее-Бур.; Zee-Bureinsky)
- 37. Udsu (Удс.; Udsu)
- 38. Ussuri (Уссури.; Ussuriysky)
- 39. Sakhalin (Сах.; Sakhalin)

VII. CENTRAL ASIA (СР. АЗИЯ; Srednyaya Aziya)

- 40. Aral-Caspia (Арал-Касп.; Aralo-Kaspiysky rayon)
- 41. Balkhash (Прибалх.; Pribalkhashsky)
- 42. Dzungaro-Tarbagatai (Дж.-Тар.; Jungaro-Tarbagataysky)
- 43. Kyzyl Kum³ (Кыз.-Кум.; Kyzyl-Kumsky)
- 44. Kara Kum (Кара-Кум.; Kara-Kumsky)
- 45. Mountain Turkmenia (Горн. Туркм.; Gorno-Turkmensky)
- 46. Amu Darya Foothills⁴ (Аму-Дар.; Amu-Dar'insky podgorny)
- 47. Syr Darya Foothills (Сыр-Дар.; Syr-Dar'insky podgorny)
- 48. Pamir-Altaï (Пам.-Ал.; Pamiro-Alaysky)
- 49. Tien Shan (Тянь-Шан.; Tian'-Shansky)

B. For indicating the general distribution of species which range beyond the Soviet Union, the following areas are employed:—

I. Arctic (Аркт.), i. e. Spitzbergen, Greenland.

II. Scandinavia (Сканд.), i. e. Norway, Denmark, Sweden, Finland,

²The Altai region is listed under Western Siberia in the text of the *Flora URSS* but is shown as part of Eastern Siberia on the map in the *Flora URSS*.

³Alternately Kizil Kum (Kizil, red).

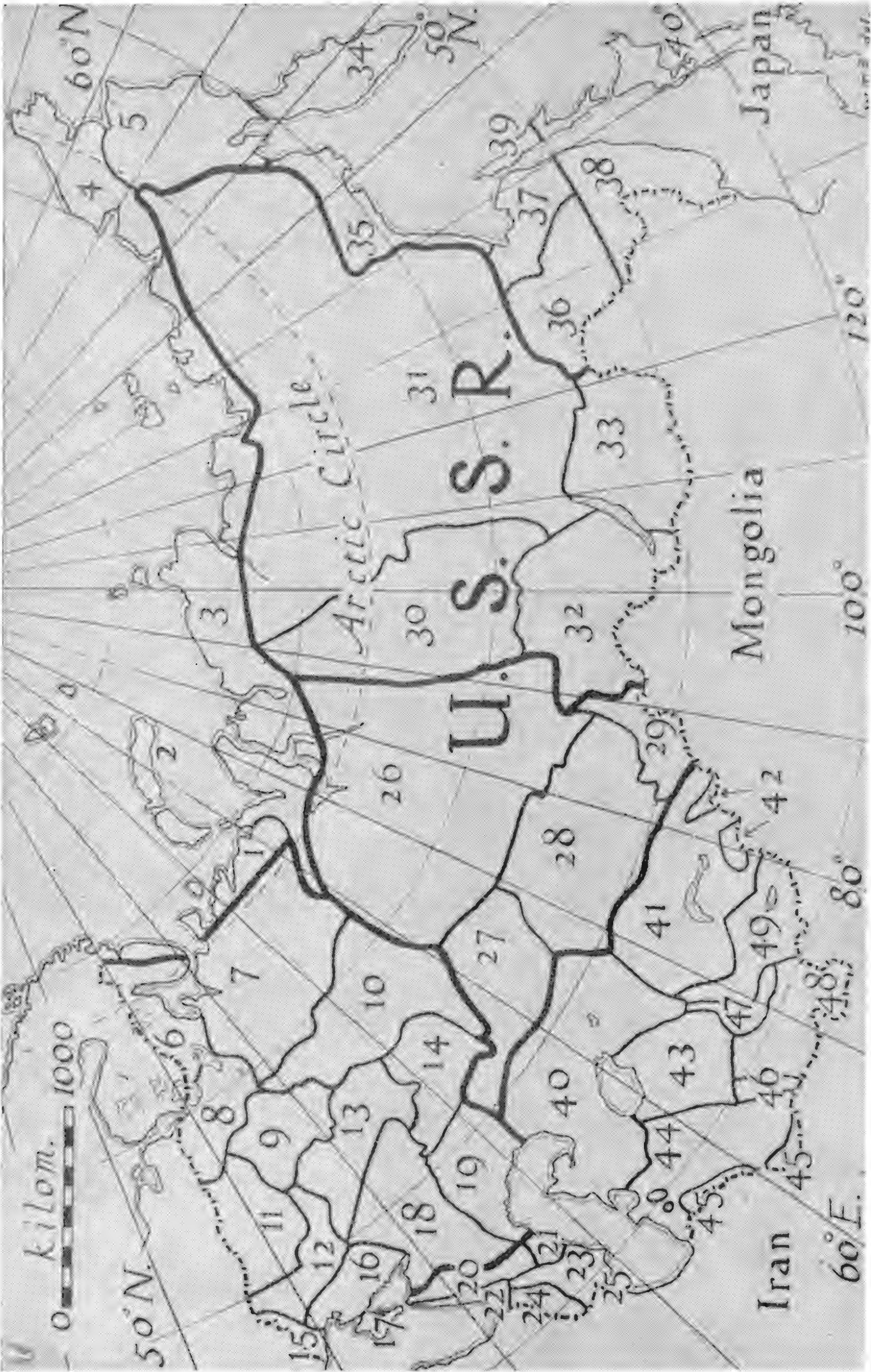
⁴Piedmont, the beginning of the mountain slope' is possibly a better rendering for подгорье (podgor'ye) than 'foothills', though less convenient; the region lies mostly between 200 and 500 meters.

Estonia and Latvia.

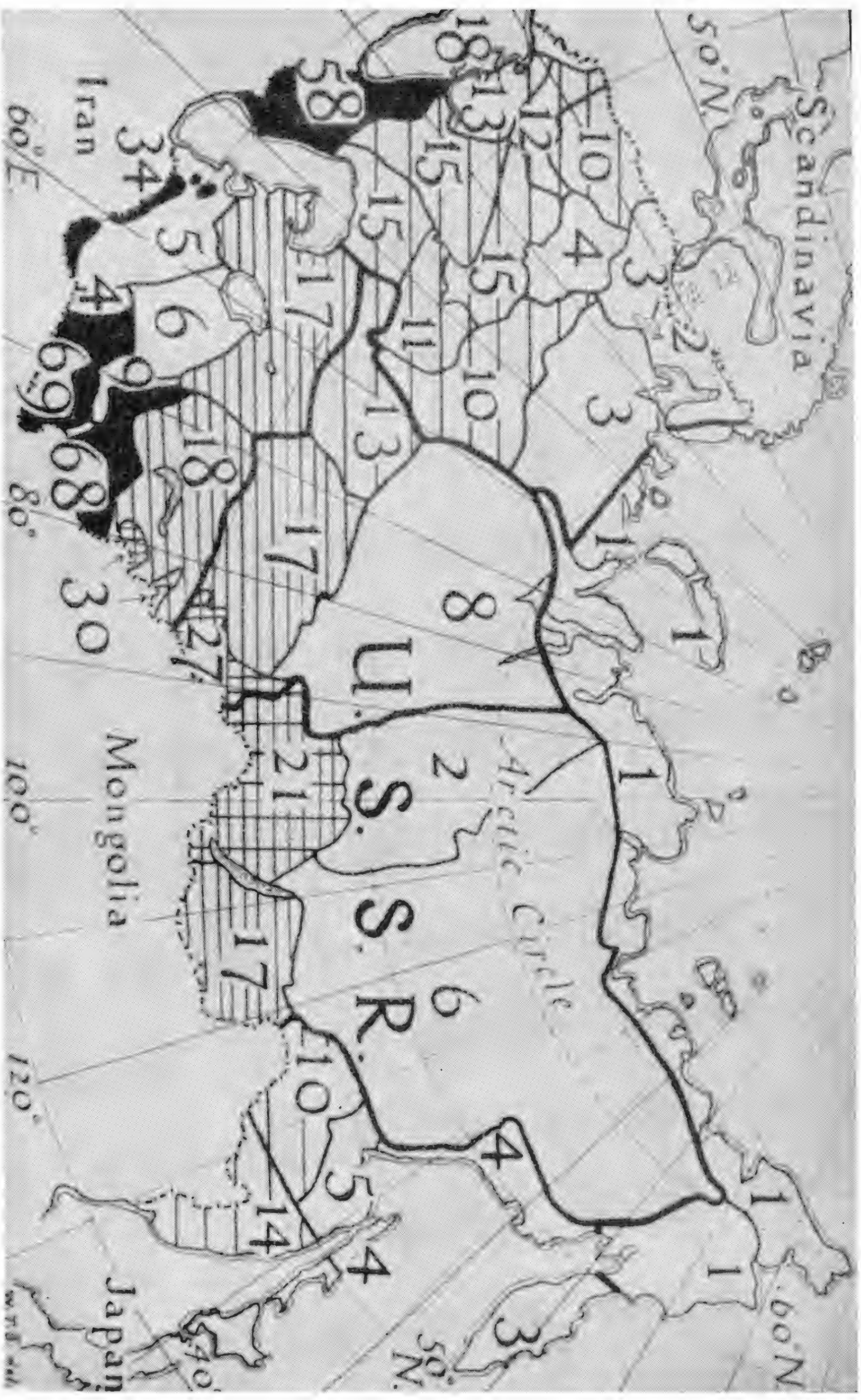
- III. Central Europe (Ср. Евр.), i. e. Germany, Lithuania, Poland, Czechoslovakia, Hungary, Austria, Switzerland.
- IV. Atlantic Europe (Атл. Евр.), i. e. Holland, Belgium, the British Isles, France, Portugal.
- V. Mediterranean (Средиз.), i. e. (1) Spain, Italy, Algeria, Tunisia, Tripolitania; (2) Cyrenaica, Egypt, Palestine, Syria.
- VI. Balkan Peninsula and Asia Minor (Балк.-Малоаз.)
- VII. Turkish Armenia and Kurdistan (Арм.-Курд.)
- VIII. Iran (Иран), i. e. (Persia and Afghanistan)
- IX. India and the Himalaya (Инд.-Гим.)
- X. Eastern or Chinese Turkistan (Дж.-Кашг.), i. e. Kuldja district, Dzungaria and Kashgaria.
- XI. Mongolia (Монг.)
- XII. Japan and China (Японо-Кит.), i. e. northern China, Manchuria, Korea, Japan, with southern Sakhalin (Karafuto) and Kurile Islands.
- XIII. Alaskan (or Eastern) coast of Bering Sea (Беринг.)
- XIV. North America (Сев. Ам.), i. e. Canada and U. S. A.
- XV. Tibet (Тиб.)

2. *Distribution of Allium in U. S. S. R.*

Two hundred and twenty odd species of *Allium* are described by A. I. Vvedensky in the *Flora URSS* 4. 112-280 (1935) as native of the Soviet Union. The policy of the *Flora URSS* is to recognize as independent species all populations possessing constant inherent features by which they can be distinguished from other populations, no matter how closely related these populations are (Komarov, 1934). The species adopted in the *Flora URSS* thus correspond to the subspecies, varieties and geographical races of many authors. For statistical comparison of areas this policy should be kept in mind, because an area from which a large number of small units has been described appears to be floristically richer than a similar area from which a smaller number of more broadly defined units has been described, although the flora may be the same in both. When, however, areas have been studied on the same lines, comparison of the number of species in each can be made. Provided the areas are not too heterogeneous, i. e. are defined so as not to include too great a variety of geographical conditions, such comparison may throw light on past migrations and the influence of regional conditions upon species-building as well as indicate the areas most likely to yield plants worthy of cultivation. The floristic regions adopted in the *Flora URSS* are intended to enclose topographically uniform areas, lowland regions being separated from mountain areas, etc., and as Vvedensky's work covers them all by grouping his species under these regions the general distribution of *Allium* within the Soviet Union becomes clear (Plate 260).



Map 1. Floristic Regions of U. S. S. R. adopted in Flora URSS; for names see corresponding numbers in List No. 1 in the text.

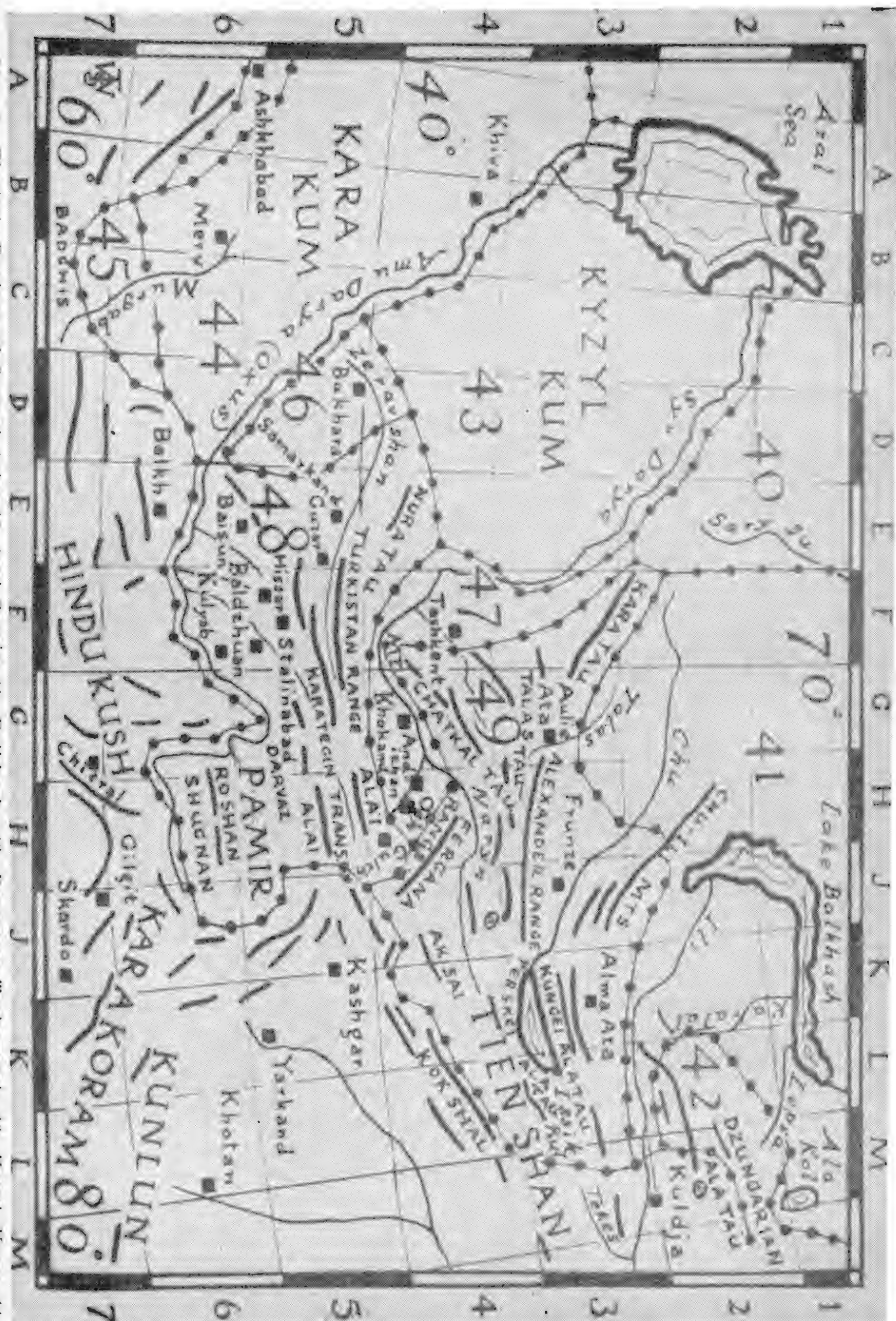


Map. 2. Distribution of *Allium* in U. S. S. R.; the figures state the number of species recorded from each region up to 1935.

Of the major parts of the Soviet Union, the most interesting to the student of *Allium* and the most promising to the gardener seeking new bulbous plants is undoubtedly CENTRAL ASIA (Plate 261). This stretches from the Kirgiz Steppe (north of the Aral Sea and Lake Balkhash) to the Soviet frontier with Persia and Afghanistan; the Caspian Sea and the Ural River bound it in the west and the Soviet frontier with Chinese Turkistan bounds it in the east. The whole area occupies about 1,417,000 square miles. For the most part it is a land of harsh climate, suffering great variation in temperature, daily as well as seasonally, and becoming very cold during the winter; the air of the lowlands is dry and precipitation slight, while violent parching winds often sweep over the deserts and steppes. Snow lies on the high mountains and their glaciers are among the world's longest. Here, in the mountainous Tien Shan and Pamir-Alai regions, the genus *Allium*, like the genus *Tulipa*, attains its greatest number and diversity of species. It is represented by about 145 species of which 81 are endemic, but there is a great contrast between the poverty of the lowland regions and the wealth of the mountains. The low-lying Amu Darya, Syr Darya, Kyzyl Kum and Kara Kum regions (Plate 261, nos. 43, 44, 46, 47) contain only 4 to 9 species each, the most widespread being *A. Borszczowii*, *A. filidens* and *A. caspium*. The Aral-Caspian and Balkhash steppe-regions (nos. 40, 41) have 17 or 18 species. The whole lowland area, despite its wide expanse, musters only 30 or so species. Mountain Turkmenia (no. 45) on the other hand has 33 species, while the Tien Shan and Pamir-Alai regions (nos. 48, 49) have 105 species between them, of which 61 are endemic; 26 are confined to the Pamir-Alai, 22 to the Tien Shan; 32 species are common to the two regions and of these 13 are not found elsewhere. The number of endemic species is thus remarkably high. There are 19 non-endemic species occurring in both Pamir-Alai and Tien Shan, 11 non-endemics occurring in Pamir-Alai (but not in Tien Shan) and 14 non-endemics occurring in Tien Shan (but not in Pamir-Alai). The ranges of these non-endemic species vary greatly; many are confined to Central Asia, but some occur also in Persia and others in Chinese Turkistan, from which areas the mountains of Central Asia must have been recolonized on the retreat of the ice. The differences between the *Alliums* of the Pamir-Alai and the Tien Shan are probably due in part to the one region receiving most of its original species from the west, the other receiving most from the east.

The *Aral-Caspian* region (no. 40) consists of the western part of the Kazakh Republic. It is a steppe region, not rising much above 500 meters. Seventeen species are recorded, none endemic. The adjacent *Balkhash* region (no. 41) comprises the steppes around Lake Balkhash and corresponds roughly to the eastern lowland part of the Kazakh Republic. Eighteen species of *Allium* are recorded, none endemic; 8 of these grow also in the Aral-Caspian region.

The *Dzungaro-Tarbagatai* region (no. 42) consists of the mountains of the Dzungarian Ala Tau and the Tarbagatai which stand between the



Map 3. Floristic Regions of Central Asia: 11, Aral-Caspian; 12, Balkhash; 13, Dzungara-Tarbagatai; 14, Kyzyl Kum; 15, Kara Kum; 16, Mountain Turkmenia; 17, Amu Darya Foothills; 18, Syr Darya Foothills; 19, Pamir-Alai; 20, Tien Shan. (---), approximate boundary of regions; M., T., Mogol (Tau).

lowlands of the Balkhash region and Dzungaria. These mountains connect the Altai region with the Tien Shan. Thirty species of *Allium* are recorded from Dzungaro-Tarbagatai, one, *A. robustum*, being apparently endemic; 18 of these occur also in the Tien Shan, of which it is floristically a northern extension and from which it is separated by the valley of the river Ili.

The *Kyzyl* or *Kizil Kum* (no. 43) is a lowland desert region lying between the Syr Darya and Amu Darya rivers. Six species of *Allium* are recorded, none endemic.

The *Kara Kum* (no. 44) is a similar lowland region lying south of the Amu Darya and corresponding to the lowland part of the Turkmen Republic. To the south, where the waters of the Murgab river lose themselves in the sand, is the fertile oasis of Merv, traditional site of the Garden of Eden. None of the 5 species of *Allium* recorded are endemic; *A. giganteum*, said to have been introduced by E. O'Donovan from Merv but more probably coming from the mountains between Merv and Meshed in Persia, occurs also in the Pamir-Alai region and in Afghanistan.

Mountain Turkmenia (no. 45) forms the Soviet frontier region with Persia and northwest Afghanistan and is floristically a northern extension of Khurasan. Thirty-four species of *Allium* are recorded from this mountain region, among them *A. Christophi* (*A. albopilosum*), 5 being probably endemic.

The *Amu Darya* foothill region (no. 46) comprises the lowlands north of the middle course of Amu Darya; it includes the city of Bukhara but not the western mountains of the Pamir-Alai region which formed part of the old Moslem Khanate of Khiva and which are often referred to as "Buchara" or "Bokhara" in botanical literature. It is part of the Uzbek Republic. Four species of *Allium* are recorded, none endemic.

The *Syr Darya* foothills region (no. 47) consists of the lowlands between the Kara Tau and the Syr Darya and also those on either side of the river up into the Fergana basin. Only 9 species of *Allium*, none endemic, are recorded from this sheltered and fertile region, which in Tsarist times formed part of the Khanate of Khokand.

To describe in a few words the intricate mountain systems which make up the *Tien Shan* and Pamir-Alai regions (nos. 48, 49) is impossible. Access to these mountains is provided by eight main rivers and their tributaries. As one ascends their valleys, the fertile irrigated lowlands give place to forests and these to treeless meadows and regions of perpetual ice and snow. The Tien Shan may be visualized as extending westward from its highest point, Khan Tengri (7200 meters) in three long irregular ridges, with lesser mountains north and south of them. Its principal river, the Naryn, flows westward into the Fergana basin, which separates the Tien Shan from the Pamir-Alai region. Most of the rivers of the Pamir-Alai flow southward into the Amu-Darya river, which constitutes its southern boundary.

The *Pamir-Alai* region (no. 48) is for the most part a bleak treeless land of very high mountains, with inhospitable plateaus, vast glaciers and innumerable wide high-level valleys scantily clad with grassy vegetation and scrub. The soils are poor, rocky and well-drained; the winter season is long and severe. Most of the area lies well above 1000 meters and its highest peaks reach 7127 and 7495 meters. It belongs mostly to the Tajik Republic. From this wild region, scenically one of the grandest in the world, 69 species of *Allium* are recorded, 26 of them endemic; the future will see these figures increased, for many species are limited in range and many valleys difficult of access remain to be intensively explored.

The *Tien Shan* region (no. 49) is of similar character and comprises the mountains north and east of the Fergana basin. The Kara Tau is in the Kazakh Republic, but most of the region belongs to the Kirgiz Republic. The Tien Shan proper (Chinese *t'ien*, heavenly *shan* mountain) is in Chinese Turkistan. Sixty-eight species of *Allium* are recorded from the Tien Shan region of the Soviet Union, 22 being endemic.

When in the 4th century B. C. the Greeks under Alexander penetrated into the western deserts and fertile foothill regions of Central Asia, into Margiana, Sogdiana and Bactria, the country was then inhabited by Iranian-speaking people and so continued for the next five centuries. Later Arabs from the southwest, Turks and Mongols from the northeast and Russians from the northwest swept over it, conquering and destroying, then settling and colonizing. These movements of peoples have left their mark upon its geographical names. Iranian, Arabic, Russian, Chinese and Mongolian names have to be faced by the botanist tracing the distribution of *Allium* in Central Asia, but the predominant names are of Turki origin. All over the map occur such Turki words as *ak* (white), *kara* (black), *kul* (lake), *kum* (sand), *sary* (yellow), *su* (water) and *tau* (mountain). In mountainous country, plants, animals and men tend to colonize in the same manner by penetrating up the valleys. Into the Pamir-Alai region the tributaries of the Amu Darya provide the easiest and often the only means of access, and this river emerges into the lowlands nearest to Persia. Thus it is not surprising that Iranian speech persists most in this region of Central Asia, in Tajikistan and Afghanistan, and that its *Allium* flora reveals traces of emigration from Persian areas of refuge. The Tien Shan region shows in its flora as in its place-names a greater affinity with Eastern (or Chinese) Turkistan. Thus the parallel migrations of plants and men in this difficult country might possibly be revealed by mapping in detail the distribution of species in genera like *Allium* and comparing this with the distribution of languages and dialects in the same regions.

In striking contrast to Central Asia, the *Arctic* possesses only one species, *A. Schoenoprasum*, and this occurs even on Novaya Zemlya (no. 2), although it does not reach Spitsbergen. It has, however, the widest range of all *Alliums* and its Arctic stations form only the fringe of a much greater area outside the Arctic.

No high mountains diversify the *European* part of the U. S. S. R. Within this land of plains and not very high plateaus, 36 species are native, but only one, *A. Marschallianum*, is endemic; this Crimean plant is not well distinguished from the widespread *A. saxatile* and may possibly occur in the Caucasus. Almost all the others are species of wide range. Their numbers decrease from south to north, the *Crimea* (no. 17) possessing 18 species, the southern and middle regions (nos. 10-16, 18-19) 15 to 10 species, the northern regions (nos. 6-9) only 4 to 2 species, namely *A. Schoenoprasum*, *A. angulosum*, *A. oleraceum* and *A. Waldsteini* (cf. Plates 259 and 260). Although the Crimea is small in area, a range of mountains lies along its southern coast and its *Allium*-flora is almost identical with that of *Ciscaucasia*.

Western Siberia (excluding the mountainous Altai region, no. 29), *Eastern Siberia* (excluding the mountainous Angara-Sayan region, no. 32) and the *Far East* are even poorer in species of *Allium* than European Russia, since they are largely areas of frozen or partly frozen soil covered with tundra and forest. Western Siberia without the Altai possesses 21 species; with the Altai it has 36 species. Eastern Siberia without Angara-Sayan possesses 17 species, with Angara-Sayan 25 species. The Altai, with 27 species, and Angara-Sayan, with 21 species, adjoin one another; both lie on the southern border of the Soviet Union and are regions of mountainous character, offering a greater variety of habitats than the forested northern lowlands, they possess 18 species in common. The most widespread of the Siberian and Far Eastern species are *A. Victorialis*, a broad-leaved forest garlic, *A. strictum* and *A. Schoenoprasum*, all of which occur also in Central Europe. The only endemic species are *A. Maacki* of the Ussuri region (no. 38) and *A. pumilum* of the Altai (no. 29).

The *Caucasus*, a very mountainous area, has 48 species of *Allium*, 21 being endemic. On account of its general topographic character, southern position (roughly 38 degrees to 45 degrees N.) and area, the Caucasus resembles the Pamir-Altai and Tien Shan regions more than other parts of the Soviet Union and approaches them in its number of *Allium* species. The plants themselves are mostly different; indeed *A. Schoenoprasum*, *A. oreophilum*, *A. scabriscapum* and *A. caspium* seem to be the only species they have in common. Eight species are recorded for *Talysh* (no. 25), 14 for *West Transcaucasia* (no. 22), 20 for *Dagestan* (no. 21), 21 for *Ciscaucasia* (no. 20), 28 for *South Transcaucasia* (no. 24) and 31 for *East Transcaucasia* (no. 23).

There is thus a marked increase in the number of species from the north to the south of the Soviet Union and from the lowlands to the high mountains.

The lowland species of *Allium* are mostly well-defined and widely distributed; the areas they inhabit tend to be of uniform character over wide expanses and to offer few barriers to the spread of plants. *Allium Victorialis* and *A. ursinum* are broad-leaved species adapted for growth in forests. *A. paradoxum* and *A. (Nectaroscordum) Dioscoridis* are also woodland plants. The others prefer open country with scanty vege-

tation, for they cannot compete with lush vigorous herbage; their bulbs enable them to rest during a long cold dry season and to start quickly into growth when the warm wet season comes again. It is probable that, as in *A. vineale*, the bulbils of some species can remain dormant in the soil for several years and escape uncongenial seasons. Hence, in such regions as the mountains of Persia and Central Asia, they find conditions particularly favourable for their survival and growth, although not so favourable for wide colonization. These mountain regions possess a greater variety of species than the lowlands, but the species themselves, unlike the lowland species, are often of very limited range and are closely related to one another. This is well illustrated by the *A. nderiense* group. In Regel's monograph of 1875, this group, under the misapplied name "*A. tataricum*", is regarded as being all one species, widespread in the deserts and steppes of southern Russia and southwest Siberia, the valleys of Turkistan and north Persia, and possessed of great variability. Vvedensky (1935) has analyzed this into eleven species. The best known, *A. nderiense* (named from the Inder Lake near the Ural River) is a lowland plant with a wide range from the Lower Volga region (no. 19), north of the Caspian Sea, to the Balkhash region (no. 41). The others are mountain plants with more restricted ranges which tend to overlap but are not identical and thus appear to extend from different centers. Their collective range is from north Persia and north Afghanistan over the Pamir-Alai region (no. 48) to the Tien Shan region (no. 49). They differ among themselves principally in the width of the leaves, the density of the umbel, the relative length of the pedicels to the flowers, and the depth of the flower-colour. Much of the territory occupied by these not very well differentiated species was probably heavily glaciated during the Ice Ages. They thus appear to be young species derived from lowland populations which colonized the valleys running into the mountains from the west on the retreat of the ice and the ensuing change in the lowland climate. Isolated among the mountains such populations acquired features differentiating them from other populations, chiefly of a quantitative nature with a different mean to their range of variation; later spreading brought about the present occasional overlapping of ranges and may also in some districts have led to a mingling of characters. As the genus *Allium* has today its greatest concentrations of species in mountain areas productive of differentiation in this way, it would appear to be a genus in which species-building has proceeded fairly rapidly since the Ice Ages, but the wide range of the genus as a whole and its great morphological diversity indicate clearly that major well-differentiated types arose long before then.

To such pre-glacial types a revised grouping of the species into sections and subsections (cf. Hermann, 1939) may provide a guide. Regel admitted only six sections (*Porrum*, *Schoenoprasum*, *Rhizirideum*, *Macrospatha*, *Molium*; and *Nectaroscordum*, which can well be considered a distinct genus). Vvedensky adopts nine (*Anguinum*, *Ophioscorodon*, *Rhizirideum*, *Phyllodolon*, *Cepa*, *Haplostemon*, *Porrum*, *Molium*; *Coloscordum*, and *Nectaroscordum*). His classification is ad-

mittedly provisional and the sections *Rhizirideum*, *Haplostemon* and *Molium* might usefully be further divided; the others seem natural groups. Section *Anguinum* (syn. *Nikeprason*) is represented in U. S. S. R. by only one species, *A. Victorialis* (Plate 262), of wide range (from Portugal to Kamchatka) but displaying within that range such regional variation as to lead to its division by Prokhanov (1931) into four minor species; *A. Victorialis* proper of Europe (and the Caucasus?), *A. microdictyon* of the Ural mountains, central Siberia and Mongolia, *A. ochotense* of Kamchatka and Sakhalin, and *A. latissimum* (*A. Victorialis* subsp. *platyphyllum* Hultén) of Kamchatka, the Ussuri region, Japan, Korea and northeast China, this last being probably tetraploid. In Europe *A. Victorialis* is a fairly uniform species, the only representative of its section. In China—not only does *A. Victorialis* show an almost protean variation; it possesses allies in *A. Listera* (Chihli), *A. funchiaefolium* (Hupeh) and *A. ovalifolium* (Yünnan) as well as in *A. caput-medusae* of upper Burma (Plate 262). Section *Anguinum* is thus essentially an East Asiatic group; it extends along the Himalaya and into Siberia but avoids Central Asia*.

* The following is a provisional synopsis of the *Anguinum* Alliums; it does not include the imperfectly characterized *A. ochotense* Prokh. (1931) and *A. cannaefolium* H. Lév. (1914), both of which come under *A. Victorialis* sensu lato, and like *A. latissimum* and *A. microdictyon* are apparently worthy of no more than sub-specific rank.

- A. Leaf-blade narrowly to broadly elliptic (i. e. broadest about the middle and narrowing to both ends), the base wedge-shaped or rounded, not cordate, the tip acute, rarely acuminate.
- B. Blade tapering into petiole, narrowly elliptic to elliptic (2-6 times as long as broad) *A. Victorialis* L. (1753) sensu lato
- C. Bulb-envelopes well-developed, to about 8 cm. high; leaf-blades 3-4, about 2-4 times as long as broad, up to 7 cm. broad.
- D. Sheaths purple. Europe. *A. Victorialis* L. sensu stricto
- DD. Sheaths green. Far East *A. latissimum* Prokh. (1931)
- CC. Bulb-envelopes reduced, to about 3 cm. high. Leaf-blades usu. 2, about 4-6 times as long as broad, narrower (up to about 3 cm. broad). Sheaths purple. Siberia, Mongolia. . . . *A. Microdictyon* Prokh. (1931)
- BB. Blade rounded at base, broadly elliptic (about 1½ times as long as broad), up to 9.5 cm. broad. N. E. China. . . . *A. Listera* Stearn (1934)
- AA. Leaf-blade lanceolate to broadly ovate (i. e. broadest below the middle), the base cordate or subcordate, the tip acuminate.
- E. Pedicels ascending. Perianth-segments white or yellowish, 3-4 mm. long. Stamens about 6-7 mm. long.
- F. Blade ovate to broadly ovate, large (13-18 mm. long, 7.5-11.5 cm. broad), one to a stem, the base deeply cordate, the basal sinus about 1.3 cm. or less deep, the margin smooth; petiole 7.5-15 cm. long. Pedicels 10-25 mm. long. Central China *A. funchiaefolium* Hand.—Mazz. (1920)
- FF. Blade lanceolate to narrowly ovate, smaller (7.5-13 cm. long, 3-5.5 cm. broad), two to a stem, the base shallowly cordate, the basal sinus 7 mm. or less deep, the margins ciliated with minute papillae (visible under lens); petiole 4-5.5 cm. long. Pedicels 4-13 mm. long.
- W. China. *A. ovalifolium* Hand.—Mazz. (1920)
- EE. Pedicels drooping. Perianth-segments purplish red, about 1.2 cm. long. Stamens about 1.8 cm. long. Blade narrowly ovate to ovate (11-12 cm. long, 5-8.5 cm. broad), two to a stem, the base shallowly cordate, the margin smooth; petiole 6-10 cm. long. Pedicels 1-2 cm. long. Upper Burma. . . . *A. Caput-Medusae* Airy-Shaw (1931)

Section *Ophioscorodon* (Syn. *Arktoprason*) is another broad-leaved section of woodland habitat, but the range of its one species, *A. ursinum*, bears no resemblance to that of *A. Victorialis*; it is widespread and abundant in northern Europe, avoids the Mediterranean lands and reaches its eastern limit in the Volga-Don region (n. 13).

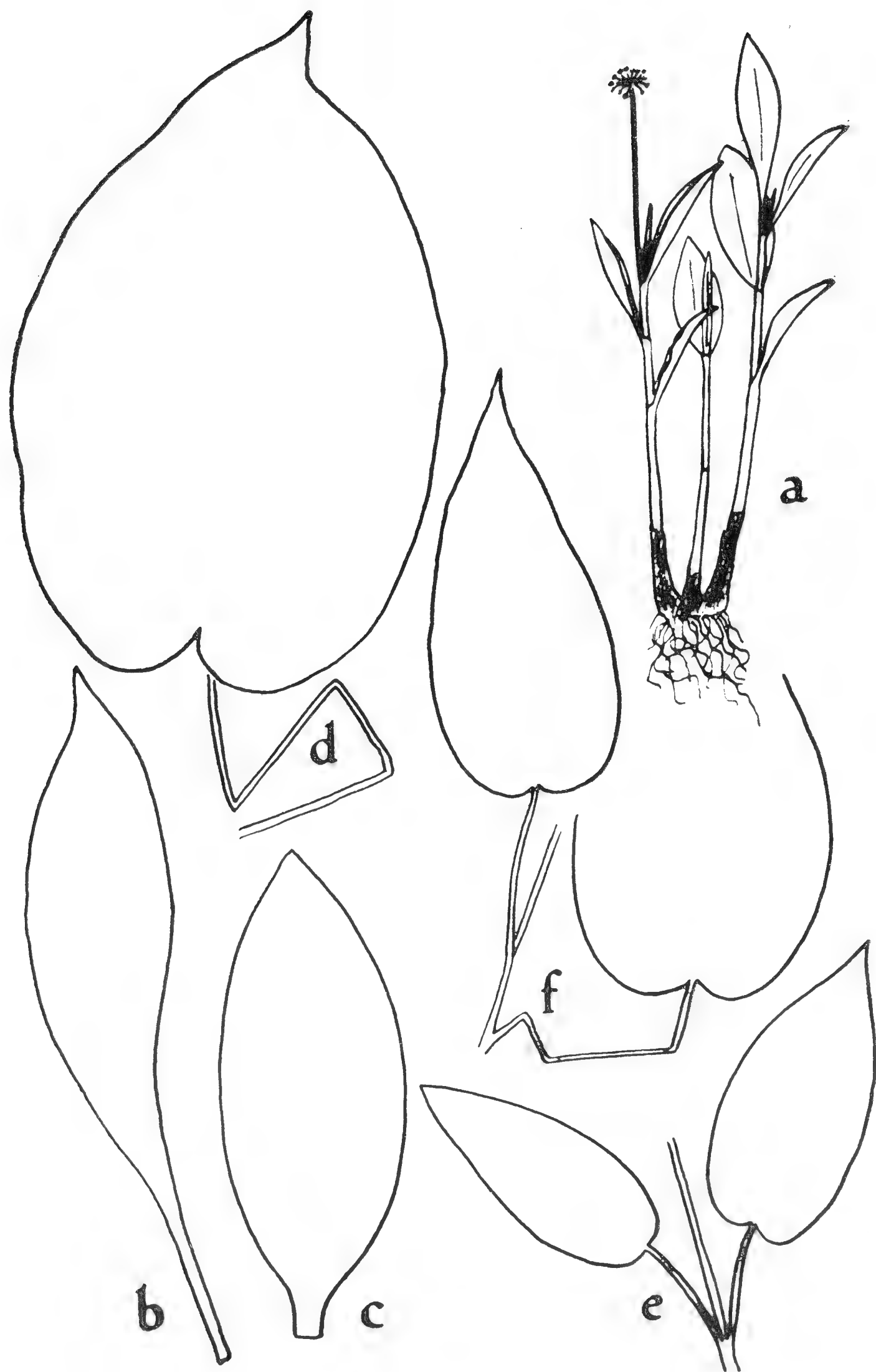
Vvedensky fuses sect. *Molium* (syn. *Rhodoprason*), with two ovules in each chamber of the ovary, and sect. *Melanocrommyum* (syn. *Melamprason*), with numerous ovules, presumably on account of several species in Central Asia possessing up to 7 or 8 ovules in the whole ovary. Sect. *Melanocrommyum* probably represents a primitive state of the genus. Many of its species are robust large-flowered herbs with fairly broad, strap-shaped, basal leaves and simple stamens. Its general range covers the Mediterranean region and extends into Western Siberia, but the greatest concentrations of species are in Western Asia and Central Asia. Section *Molium* is essentially a Mediterranean group and has by no means so great a range in Asia; it is represented by only a few species in the U. S. S. R. *A. monanthum* of the Ussuri region, placed by Vvedensky in *Molium*, is probably best regarded as constituting a distinct section *Microscordum*.

Sections *Phyllodolon* and *Cepa* are quite distinct from one another in distribution as in morphology. *Phyllodolon* is a group of south-east Siberia and Mongolia and has contributed *A. fistulosum* to Far Eastern kitchen gardens. *Cepa* is a group of Central Asia, with Afghanistan and Persia, and gave the world the common onion, *A. Cepa*. Sect. *Porrum*, taking its name from the Leek, *A. Porrum*, is likewise a natural group; it represents the extreme development of the tendency in the genus for the inner three stamens to be broader than the outer three and of different form. The plants are mostly small-flowered and many are of small growth with narrow leaves sheathing the stem for much of its height. They represent an advanced state of development. This section is widespread in Europe, North Africa and Western Asia, but does not reach Siberia; it has seven species in the Pamir-Alai region but only two in the Tien-Shan.

The section *Haplostemon*, as accepted by Vvedensky, is a very heterogeneous group, part of which, namely *Macrosphatha* (syn. *Codonoprason*, *Rhynchoprason*), seems to deserve separation. This is a European and west Asiatic group, not extending east of Mountain Turkmenia, whereas the most of other species are confined to Central Asia.

The section *Rhizirideum* has the widest distribution of any group, even if the well nigh ubiquitous *A. Schoenoprason* be left out of consideration. Its greatest concentrations of species are in Eastern and Central Asia. It is a very heterogeneous group.

Although large numbers of species are confined to Central Asia, no section of the genus is endemic here. Central Asia tends to be the boundary of the ranges of sections having their centers elsewhere. Thus its importance as the region wherein *Allium* is now most richly represented is evidently the result of species-formation since the retreat of the ice; it is a meeting place for plants, as for men, of populations from the east and the west, and to this and to the favourable con-



Leaf-form in *Allium* sect. *Anguinum*. ..*A. victorialis*, European form, cult., (a) habit, (b) upper leaf, (c) lower leaf; *A. funckiaefolium* (Henry 5590 F), (d); *A. ovalifolium* (Hand.—Mozz. 7045) (e); *A. Caput-Medusae* (Ward 3416) (f).

ditions it has offered for their further evolution is to be attributed the remarkable diversity of its species.

3. Index of the Places in Central Asia

It is often difficult to find on maps the places named in Eduard von Regel's *Allii Species Asiae Centralis* (Acta Horti Petrop. 10: 281-366. 1887) and other literature on the Alliums of the Pamir-Alai and Tien Shan regions, or even to ascertain the approximate positions of such places. Plate 261 shows at a glance the floristic importance of Central Asia; many beautiful and interesting plants have been introduced from there in the past and many await introduction or reintroduction into American and British gardens. Difficulties arise from the lack of adequate readily accessible maps, the diversity of forms which Turki, Iranian, Arabic and Russian names assume when romanized according to different systems, the use of the same name for different places and of different names for the same place. The Russian names Wernoje and Verni and the Tartar name Alma Ata, for example, refer to the same place; Aksu (*ak* white, *su* river) is the name of several rivers, and so on. Regel's German origin naturally led him to write these place-names in a German manner, using letters with German phonetic values. Hence in attempting to find the places he lists it is well to remember this fact. For the convenience of the reader, phonetic equivalents in the German, Polish, Russian and English languages are given in Table I.

(German *Tschu*, for example, corresponds to English *Chu*; German *Serawschan* to English *Zeravshan*, and so on. The type-locality of *Allium gulczense* (Russian Гульча) may be rendered *Gulcha*, *Gultscha* or *Gulcza*; the last is in Polish transliteration, which has often been adopted by Russian authors for the romanization of Russian and Central Asian personal and geographical names.)

Fortunately for the enquiring botanist, in 1881 Regel's explorer son Albert, whose collections enriched European gardens and herbaria

TABLE I

Phonetic equivalents in the German, Polish, Russian and English languages.

German	Polish	Russian	English
ch		x	kh
d			t
dsch		дж	dz, dzh or j
j			y
k			c, k or q
	rz	ж	zh
s		з	z
sch	sz	ш	sh, zh
schtsch	szcz	щ	shch
tsch	cz	ч	ch
v		ф	f
w		в	v
z		ч	ts

with so many new plants from Central Asia, published an *Index Locorum Natalium* (Acta Horti. Petrop. 7:ii. 667-677) together with a detailed map of the Tien Shan region on which his routes and those of Fedtschenko, Kaulbart, Kuropatkin, Oster-Sacken, Przewalski and Sewerzow are marked. From this list the following list is mainly derived. It gives the appropriate position of almost all the Central Asiatic places mentioned in the first seven volumes of the Acta Horti Petrop. and also of many places mentioned in later literature, but it is not complete. War conditions have made it impossible to trace all the places named as habitats of *Allium*. Many names have been left in the German orthography adopted by Regel, since some of them are undoubtedly corrupt and to supply correct English equivalents demands access to good modern official maps and a knowledge of Turki, Arabic, Persian, Mongolian and Chinese which the present compiler does not possess. The list is a guide to the localities where Alliums and other plants have been collected in the past and whence, it is hoped, they will be collected again in the future; it is not an attempt to standardize the spelling of place-names.

Plate 261 shows the approximate boundaries (marked -.-.-.-) of the floristic regions of Central Asia as indicated by statements in the text of the *Flora URSS*. It is to be hoped a more accurate and detailed official map will later supersede this sketch-map. The positions of places named below may be found by means of the grid. For further precision, imagine each quadrangle divided into four smaller quadrangles, each representing one degree of latitude by one of longitude; the top left is represented in the grid-references below by the letter *a*, the top right by *b*, the bottom left by *c*, the bottom right by *d*. Hence Tashkent, having grid-reference 4Fb, is located in the top right division of quadrangle 4F.

The following abbreviations are employed: (E) = English rendering; E. = East; (G) = German rendering; Mt(s) = mountain(s); N. = North; R. = river; S. = South; W. = West.

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THE GENUS *ALLIUM* IN THE USSR

A. I. VVEDENSKY

(Translated from V. L. Komarov, *Flora URSS* IV (1935) 112-280, by H. K. Airy Shaw, B. A., F. L. S., Royal Botanic Gardens, Kew, England.)

[The scope, format and policy of the *Flora URSS* was decided at a conference of Soviet plant-geographers and taxonomists in 1931 and Professor V. L. Komarov was made general editor. It is only by team-work that the flora of so great an area as the Soviet Union can be written within a reasonable time and the writing up of different groups was accordingly entrusted to botanists who seemed best qualified to deal with them. Volume IV (1935) is the work of no less than fourteen botanists. The account of *Allium* by A. I. Vvedensky in this volume (pp. 112-280) is the most important contribution to our understanding of the genus which has been published in the present Century. Vvedensky's interest in *Allium* goes back many years. He has published more than forty new species, and, as botanist at the University of Central Asia in Tashkent, which stands on the fringe of the mountains wherein the genus attains its greatest diversity and number of species, he has had opportunities of observing many of them in the living state, while his studies of specimens in the rich Leningrad Herbarium, containing all Regel's type-material as well as authentic specimens of many species described by other botanists, have given opportunities for that critical interpretation of the older literature which is so necessary in a flora employing such narrowly defined units as the *Flora URSS* does. This account of *Allium* provides detailed descriptions of more species than any work since Regel's *Alliorum adhuc cognitorum Monographia* of 1875. It fits into a systematic framework a large number of little-known species discovered since then, indicates their distinguishing features and distribution and makes readily accessible much hitherto scattered information about them, at the same time improving the commonly accepted classification of the genus. It is thus of high value to students of *Allium* outside as well as inside the Soviet Union. The original work is in Russian.

Certain differences which will be noted between this translation and the original require explanation.

1. *Bibliography.* All errors, inaccuracies or omissions in citations, whether of author, title, volume, date or page, which it has been possible to detect, have been corrected. The majority are due to Mr. W. T. Stearn; the more important are commented upon in footnotes, over the initials W. T. S., but minor corrections have been incorporated without comment. These footnotes, and all major additions in the text, are enclosed in square brackets []. All footnotes not enclosed in square brackets form part of the original account.

2. *Geography.* With very few exceptions, the spelling of place-names has been brought into accordance with the recommendations of the Permanent Committee on Geographical Names, Royal Geographical Society. Hyphens have accordingly been omitted throughout, except in certain names of Persian origin, and in compound names derived from two distinct place-names (e. g. Pamir-Alai, Chu-Ili, etc.).

3. *Specific epithets.* In many cases of specific epithets derived from names of persons or places, Vvedensky has adopted a spelling differing—sometimes considerably—from the original. In all such cases, the original spellings (for which I am indebted to Mr. Stearn) have been restored, even when Vvedensky's spelling is easier or otherwise preferable for English-speaking people, since the International Rules of Botanical Nomenclature permit the original to be altered only in cases of "unintentional typographic or orthographic error."

In a few instances, where the original spelling of accepted specific epithets, derived wholly or partially from Latin or Greek, is faulty and may charitably be attributed to such "unintentional . . . error," minor corrections have been made (e. g. '*hymenorhizum*' to *hymenorrhizum*; '*firnotunicatum*' to *firno-tunicatum*; '*pseudoseravschanicum*' to *pseudo-seravschanicum*; etc.).

4. *Russian authors' names.* A uniform system of transliteration has been adopted throughout, with the object of making such names more intelligible to English-speaking botanists. The spelling here adopted differs from that employed in the *Flora URSS* in the following cases:—Albov (present translation) = Alboff (*Fl. URSS*); Bordzilovsky = Bordzilowsky; Fedchenko = Fedtschenko; Ilyin = Iljin; Kirilov = Kirilow; Maximovich = Maximowicz; Mishchenko = Mis[z]czenko; Shishkin = Schischkin; Turchaninov = Turczaninow.

5. *Misprints, etc.* In the descriptions, attention is called to a few slips, printer's errors, obscure passages, etc., either by means of foot-notes marked "Translator's note", or by the word "[sic]" in the body of the description.

6. *Miscellaneous.* Each word of the titles in the bibliographical references begins with a capital letter. Semi-colons in the Russian descriptions have been largely replaced by full-stops, with of course a capital for the word following. In the distributional paragraph under each species, a key-number has been prefixed to each phytogeographical province, referring to the corresponding number on Mr. Stearn's sketch-map.

Other minor discrepancies do not call for special comment.

—H. K. A. S.]

[This account does not include the following species described since 1935:—*A. sypsodictyum* Vvedensky in Schreder, *Fl. Uzbekist.* I (1941) 453, 543, t. 66; *A. kasteki* Popov in Bull. Soc. Nat. Mosc., Bio. n. s. XLVII (1938) 85; *A. Kurssanovii* Popov, l. c. (1938) 85; *A. Leonidis* Grossheim in Trud. Bot. Inst. Akad. Nauk S.S.S.R., Azerb. Fil.,

Baku II (1936) 246; *A. majus* Vvedensky, l. c. (1941) 462, 543; *A. rhodanthum* Vvedensky, l. c. (1941) 463, 543. —W. T. S.]

Genus ALLIUM L.

Linné, Gen. Pl. ed. 5 (1754) 143; Ledeb. Fl. Ross. IV (1852¹) 161; Boiss. Fl. Or. V (1882²) 229.

Perianth of free or \pm united segments, with 1 — 7 nerves, usually persistent and changed or unchanged after flowering. Stamens 6, \pm connate and adnate to the perianth. Anthers dorsifixed. Ovary trilocular or unilocular, with 6 or many ovules. Style attached to the base of the ovary, persistent. Seeds angular or rounded.

Perennial (under cultivation sometimes biennial) bulbous herbs, or with almost undeveloped bulbs, with a pungent smell and taste of onion (or garlic); inflorescence umbellate, enclosed when young in a spathe.

On account of their gustatory and aromatic qualities certain species of *Allium* were long ago introduced into cultivation, but in many localities the population also use wild species for food. There are records of the employment of *A. paradoxum*, *A. sabulosum*, *A. monadelphum*, *A. Schoenoprasum*, *A. saxatile*, etc., but particularly extensive use is made of *A. Victorialis* and *A. ursinum*, which the population do not distinguish, uniting them under the general term *cheremsha*, and of the wild *A. altaicum*, *A. Oschanini*, *A. pskemense* and *A. longicuspis*, which are closely related to cultivated forms. Undoubtedly these do not exhaust the list of possible edible species.

It appears, however, that the majority of species of the section *Molium* are not suitable as food, but many of them can be utilised as decorative plants; and the most effective of them (*A. giganteum*, *A. Christophi*) are eagerly sought after by foreign nursery firms. *A. coeruleum* is also greatly in demand.

The garlic odour and taste of *Allia* is due to the oil of garlic (0.005—0.009 per cent of the whole plant, according to Wehmer) which is found in all the tissues and of which the principal part, the disulphide $C_6H_{12}S_2$, contains much sulphur.

In pastures *Allia* are not always desirable, even if they form a normal admixture in the usual grass fodder, since many of them communicate an unpleasant flavour to the milk of animals eating them.

The genus *Allium* as hitherto accepted, including also the account for the Flora U S S R, forms a very unnatural collective group, with extremely artificial division into sections. The great number of species (upwards of 400 in the whole world) and the lack of very many of them

¹ [Vvedensky cites Ledebour, Fl. Ross. IV. 161-190 as published in 1853. The first part of Fl. Ross. IV, i. e. pp. 1-240, was published in 1852, probably April (cf. Stearn in Journ. Arnold Arb. XXII (1941), 227), and this date has accordingly been adopted in the translation. —W. T. S.]

² [Vvedensky cites Boissier, Fl. Orient. V. pp. 229-285 as published in 1884. The first part of Fl. Orient. V., i. e. pp. 1-428, was published in July 1882 and this date has accordingly been adopted in the translation. —W. T. S.]

in the herbaria at my disposal, and also the small extent to which the *Allium* flora of China and Farther Asia—those powerful centres of *Allium*-evolution—has been studied, have compelled me to refrain from introducing any radical changes in the *Allium*-system of Don and Regel^{3,4,5} as accepted at the present day. I make an exception only for a small number of extremely isolated species, the taxonomy of which has recently been elaborated in detail by Prokhanov.⁶

Not only the want of species, but also the lack of many characteristic features in the species that are represented in herbaria, form an obstacle to work on the taxonomy of the *Allia*. When *Allia* are collected, they must be carefully dug up, in order not to disturb the integrity of the tuft [mat, turf], if the species concerned forms one, and in order not to lose the outer envelopes of the bulb, and bulblets, if the latter are present. It is also extremely important, before drying the plant, to make a sketch of a transverse section of the leaf in two places—above the base and above the middle. Very important characters are yielded by the spathe in the unexpanded state: hence it is desirable to have represented in collections specimens both in the flowering state and also with the still unexpanded spathe.

With well-collected material, the determination of *Allia* usually presents no difficulty.

1. Perianth-segments with 3—7 nerves. Pedicels discoidally expanded beneath the flower. Innermost (upper) leaf vaginiform, embracing the scape⁷ for some way up. (Sect. *Nectaroscordum*) ----- 2

³ Don, A Monograph on the Genus *Allium*. Mem. Werner. Nat. Hist. Soc. VI. (1827) 1-102.

Regel, *Alliorum adhuc cognitorum Monographia*. Acta Horti Petrop. III, 2 (1875) 1-266.

⁴ [Vvedensky cites George Don's Monograph sometimes as '1832', sometimes as '1826'. It was published early in 1827 (cf. Stearn in Journ. of Bot. LXXIV (1936) 322) and this date has accordingly been adopted in the translation. —W. T. S.]

⁵ [The reference "Regel, Fl. Turk." in the following pages is to E. Regel, *Flora Turkestanskaya: Primulaceae, Liliaceae* (1876), which forms the botanical part of A. P. Fedtschenko's work on his travels in Turkistan:— *Puteshest. Turkest. III, Bot. 1* (Izvest. Imp. Obschest. Lyubit. Estest., Antrop. i Etnogr. XXI 2). This is the work to which Regel refers in his *All. Mon.* 45, footnote (1875) and may be regarded as an illustrated supplement to the monograph: it has 22 plates, not of high quality. —W. T. S.]

⁶ Prokhanov. The cultivated *Alliums* of China and Japan. Bull. Appl. Bot. Leningrad (Tr. Prikl. Bot. Gen. & Selekt.) XXIV, 2 (1931) 123-188.

⁷ [Lit. "stem", and so throughout. —Translator's note.]

- + Perianth-segments with 1 nerve. All leaves with a lamina or only the outer (lower) ones vaginiform ----- 3
- 2. Disc *c.* 5 mm. wide. Perianth-segments persistent -----
228. *A. Dioscoridis* Sibth. et Sm.
- + Disc *c.* 3 mm. wide. Perianth-segments caducous -----
227. *A. tripedale* Trautv.
- 3. Leaves with a lanceolate, oblong or broadly elliptic lamina, gradually or \pm abruptly narrowed into the petiole. Seeds spherical or almost spherical. Capsule spherico-triquetrous with broadly obcordate valves ----- 4
- + Leaves filiform, semicylindric, cylindric, linear, loriform, or lanceolate, to broadly elliptic, never narrowed into the petiole. Seeds angular ----- 5
- 4. Bulb attached to a rhizome, with reticulate envelopes. Scape clothed with leaf-sheaths for $1/3$ — $1/2$. Perianth-segments 4—5 mm. long (Sect. *Anguinum*) ----- 1. *A. Victoralis* L.
- + Bulb not attached to a rhizome. Bulb-envelopes splitting into parallel fibres. Scape clothed with leaf-sheaths at the base. Perianth-segments *c.* 9—12 mm. long (Sect. *Ophioscordon*)
2. *A. ursinum* L.
- 5. Robust plants with a stout (7—20 mm.) scape and fistular leaves. Bulb-envelopes (in wild plants) red-brown, thinly coriaceous, entire. Flowers white or yellowish, in a spherical, more rarely hemispherical, many-flowered, dense umbel ----- 6
- + Scape usually less than 7 mm. thick, but if plants robust with a thicker scape, then leaves broad, flat, not fistular -- 13⁸
- 6. Perianth stellate, white, with segments 4—6 mm. long. Pedicels with bracteoles at the base (Sect. *Cepa*) ----- 9
- + Perianth campanulate, yellowish, with segments 6—8 mm. long. Pedicels without bracteoles. (Sect. *Phyllodolon*) -- 7
- 7. Comparatively small plant, 20—25 cm. high. Scape 7—10 mm. thick. Leaves 5—7 mm. wide -- 86. *A. microbulbum* Prokh.
- + Larger plants, 30—70 cm. high and more, with thicker scape and leaves ----- 8
- 8. Pedicels thick, slightly shorter than or (the central ones) $1\frac{1}{2}$ times as long as the perianth. Umbel almost capitate ----
87. *A. altaicum* Pall.

⁸ [The original has "12", which is evidently an error: see 11th dichotomy, 2nd alternative. —Translator's note.]

- + Pedicels slender, 2—3 times as long as the perianth. Umbel more lax. Cultivated plant -----88. *A. fistulosum* L.
9. Scape not inflated or slantingly inflated. Leaves 2—3. Filaments \pm coalescent with one another above their adnation to the perianth ----- 10
- + Scape with a \pm distinct inflation below the middle. Leaves 4—9. Filaments free above their adnation to the perianth. 11
10. Scape solid, 20—50 cm. high. Leaves 3—10 mm. wide. Perianth-segments 4—5 cm. long ----89. *A. galanthum* Kar. et Kir.
- + Scape hollow, 40—80 cm. high. Leaves 20—30 mm. wide. Perianth-segments 6 mm. long. -----90. *A. pskemense* B. Fedch.
11. Leaves flattened, canaliculate, congregated at the base of the scape, recurved -----91. *A. Vavilovi* M. Pop. et Vved.
- + Leaves cylindric, straight ----- 12
12. Scape slender above the inflation. Wild plant -----
92. *A. Oschanini* O. Fedch.
- + Scape fairly thick above the inflation. Cultivated plant --
93. *A. Cepa* L.
13. Bulbs cylindric, conical, oblong or more rarely oblong-ovoid or ovoid, solitary or aggregated, always attached to a rhizome. (Sect. *Rhizirideum*) ----- 14
- + Bulbs spherical or ovoid or more rarely oblong-ovoid, devoid of a rhizome ----- 96
14. Filaments $1/4$ — $3/4$ as long as the perianth-segments, adnate half-way to the perianth and connate for $2/3$ — $3/4$ ----- 15
- + Filaments shorter or longer than the perianth, connate for the same distance as they are adnate to the perianth ----- 17
15. Leaves 0.5—1 mm. wide, semicylindric, canaliculate. Perianth-segments rose-violet, 5—6 mm. long. Filaments $1/4$ — $1/3$ shorter than the perianth-segments -----
79. *A. Weschniakowi* Regel
- + Leaves 2—15 mm. wide. Perianth-segments 7—15 mm. long, shining, yellow, or later becoming reddish or dark-purple. Filaments $1/4$ — $1/2$ as long as the perianth-segments ----- 16
16. Leaves (2)—3, broadly linear, canaliculate, 5—15 mm. wide, not fistular -----80. *A. Semenovi* Regel
- + Leaves 1—2—(3), cylindric, fistular, 2—7 mm. wide. -----
81. *A. monadelphum* Less.

17. Leaves 1—2, fistular. Segments of the campanulate perianth rose or rose-violet, generally shining. Bulb-envelopes without noticeable nerves, crustaceo-coriaceous or almost papyraceous, breaking up. Spathe almost without a beak ----- 18
- + Leaves (2)—3—9, non-fistular, or fistular and then either the spathe with a long beak or the leaves canaliculate-triquetrous ----- 21
18. Filaments $1/3$ — $1/2$ as long as the perianth. Pedicels $1/3$ — $1/2$ as long as⁹ the perianth, more rarely equalling it -----
82. *A. Schoenoprasum* L.
- + Filaments slightly longer than, equalling, or up to $1/3$ shorter than, the perianth-segments. Pedicels ($1\frac{1}{2}$)—2—3 times as long as the perianth-segments ----- 19
19. Perianth-segments 7—12 mm. long. Style strongly exerted from the perianth -----83. *A. Ledebourianum* Roem. et Schult.
- + Perianth-segments 5—6—(7) mm. long. Style slightly exerted from the perianth ----- 20
20. Bulb-envelopes greyish, almost papyraceous. Filaments of inner stamens gradually narrowed from the base, $1\frac{1}{2}$ times as broad as the outer ones at the base -----
84. *A. Maximowiczii* Regel
- + Bulb-envelopes cinnamomeous or violet-cinnamomeous, crustaceo-coriaceous. Filaments subulate from a scarcely expanded base, almost equal -----85. *A. oliganthum* Kar. et Kir.
21. Leaves canaliculate-triquetrous or sharply carinate, 2—5 mm. wide. Filaments $1\frac{1}{2}$ times as long as the perianth-segments. Segments of the hemispherical perianth elliptic, obtuse, rose-purple or dirty-rose, darker on the back, 4—5.5 mm. long ----- 22
- + Leaves flat or semicylindric, without a keel, or with one, and then the filaments shorter than the perianth-segments ---- 23
22. Leaves (2)—3—(4), canaliculate-triquetrous, sometimes fistular at the base. Bulbs oblong-ovoid, with cracking, indistinctly reticulate-fibrous envelopes, surrounding the base of the stem. Perianth-segments rose-purple, 4.5—5.5 mm. long
3. *A. sacculiferum* Maxim.

⁹ [“1—2 times shorter than” (i. e. ‘equalling to $1/2$ as long as’) in the original. The correction here made is based upon the description in Fl. URSS. IV. 193. —Translator’s note.]

- + Leaves 4—7, canaliculate, sharply carinate. Bulb ovoid, with coriaceous entire envelopes. Perianth-segments dirty-rose, darker on the back, 4—4.5 mm. long --4. *A. Komarovianum* Vved.
23. Bulb-envelopes papyraceous, membranous or coriaceous, cracking or split into fibres, sometimes obscurely reticulate-fibrous (and then spathe without a beak, and roots numerous, almost cord-like), but never becoming reticulate ----- 24
- + Bulb-envelopes reticulate-fibrous, or obscurely reticulate-fibrous and then the spathe with a \pm long beak ----- 59
24. Filaments connate, and adnate to the perianth, half-way, almost $\frac{1}{3}$ shorter than the perianth. Umbel fasciculate, few-flowered, lax -----59. *A. setifolium* Schrenk
- + Filaments connate, and adnate to the perianth, at the base or for $\frac{1}{4}$ ----- 25
25. Bulbs ovoid-conical or almost cylindric, with coriaceous, numerous, compact, entire envelopes. Spathe either with a \pm long, sometimes very long, beak, several times exceeding the base of the spathe, or without a beak, and then the plant small, with a slender stem 10—15 cm. high, with purple flowers. Filaments longer than the perianth or (*A. Alexandrae*) shorter than it ----- 26
- + Spathe without a beak, or with a short beak and then the filaments shorter than the perianth ----- 39
26. Filaments slightly shorter than the perianth, the inner ones widened for $\frac{3}{4}$ and then abruptly narrowed, sometimes almost dentate, 3 times as broad as the subulate outer ones
73. *A. Alexandrae* Vved.
- + Filaments slightly longer than or up to twice as long as the perianth-segments, subulate almost from the base, equal or the inner ones up to $1\frac{1}{2}$ times broader ----- 27
27. Filaments slightly longer than the perianth. Perianth almost stellate, rose-purple. Umbel few-flowered, lax -----
60. *A. subtilissimum* Ledeb.
- + Filaments ($1\frac{1}{4}$ or) $1\frac{1}{2}$ —2 times as long as the perianth-segments. Perianth ovoid-campanulate or campanulate ----- 28
28. Umbel fasciculate-hemispherical, few-flowered, lax, with cernuous flowers. Perianth-segments c. 3mm. long, pale-yellow, becoming rosy. Pedicels ($1\frac{1}{2}$)—2 times as long as the perianth -----62. *A. tyttanthum* Vved.
- + Umbel spherical or hemispherical, dense, many-flowered, or few-flowered and then the pedicels shorter or only slightly longer than the perianth and the flowers rose or purple -- 29

29. Perianth-segments 5—6 mm. long, obtuse, the outer ones emarginate, the inner $1/6$ longer. Pedicels slightly shorter or slightly longer than the perianth. Stem 10—25 cm. high
66. *A. tianschanicum* Rupr.
- + Perianth-segments 3—5 mm. long, acute or obtuse with a short apiculus, the inner slightly longer than the outer. ----- 30
30. Pedicels shorter than, equalling, or very rarely up to $1\frac{1}{2}$ times as long as, the perianth. Spathe with a comparatively short beak, usually shorter than the base of the spathe, more rarely twice exceeding it, or altogether without a beak. Flowers rose or purple ----- 31
- + Pedicels $1\frac{1}{2}$ —3—(4) times as long as the perianth. Spathe with a long beak, usually several times exceeding the base of the spathe, or with a comparatively short beak and then the flowers yellow ----- 34
31. Spathe without a beak. Perianth-segments purple. Leaves flat, smooth ----- 61. *A. jucundum* Vved.
- + Spathe with a beak. Perianth-segments rose. Leaves semi-cylindric, canaliculate ----- 32
32. Filaments of the inner stamens $1\frac{1}{2}$ times as broad as the outer ones, bidentate at the base ----- 63. *A. kokanicum* Regel
- + Filaments equal, subulate ----- 33
33. Leaves almost filiform, 0.25—0.5—(1) mm. wide, smooth or more rarely finely scabrid. Filaments usually feebly coloured ----- 64. *A. filifolium* Regel
- + Leaves 0.5—1 mm. wide, ciliate-scabrid on the margin. Filaments usually purple ----- 65. *A. caricoides* Regel
34. Flowers pale-yellow. Perianth-segments subobtuse or obtuse with a short apiculus, 4—5 mm. long. ----- 35
- + Flowers white, rose or rose-purple, or pale-yellowish-green turning rose and then the perianth-segments 3—4 mm. long. Perianth-segments acute ----- 36
35. Leaves 0.5—1 mm. wide. Bulb-envelopes greyish or brownish, coriaceous, almost papyraceous -- 68. *A. petraeum* Kar. et Kir.
- + Leaves 1—2.5 mm. wide. Bulb-envelopes thinly coriaceous, brown, often shining ----- 67. *A. condensatum* Turcz.
36. Perianth-segments 3—4 mm. long, pale-yellowish-greenish, turning rose ----- 69. *A. talassicum* Regel
- + Perianth-segments 4—5 mm. long, white, rose or rose-purple 37

37. Perianth-segments rose-purple -----72. *A. globosum* M. Bieb.
 + Perianth-segments white or rose ----- 38
38. Perianth-segments rose; anthers usually violet -----
 71. *A. saxatile* M. Bieb.
 + Perianth-segments white; anthers usually yellow -----
 70. *A. Marschallianum* Vved.
39. Rhizome with runners; bulb scarcely developed. Umbel with numerous, large, 6—7 mm. long, cernuous flowers. Filaments $\frac{1}{4}$ — $\frac{1}{3}$ shorter than the perianth-segments, the inner ones almost 3 times as broad as the outer -----
 52. *A. caespitosum* Sievers
- + Rhizome without runners. Filaments of the inner stamens, not more than twice as broad as the outer ones, or broader and then the filaments longer than the perianth ----- 40
40. Filaments $\frac{1}{4}$ — $\frac{1}{3}$ shorter than the perianth-segments, expanded and entire at the base. Perianth-segments 3.5—4.5 mm. long, obtuse or truncate, obcuneate ----- 41
- + Filaments equalling, or up to twice as long as, the perianth-segments, or shorter than them; in the latter case these segments 5—6—(7) mm. long, and either acute or, if obtuse, the filaments bidentate $\frac{2}{3}$ — $\frac{3}{4}$ of the way up ----- 42
41. Umbel hemispherical, few-flowered, with cernuous flowers; pedicels almost equal, $1\frac{1}{2}$ —2—(3) times as long as the perianth. Scape 5—25 cm. high. Perianth hemispherical; inner segments obcuneate, the outer ones almost orbicular-elliptic -----
 50. *A. tenuissimum* L.
- + Umbel fasciculate or fasciculate-hemispherical, usually many-flowered. Pedicels unequal, 3—7 times as long as the perianth. Scape 20—40 cm. high. Perianth broadly campanulate; inner perianth-segments obcuneate or linear-obcuneate, the outer ones broadly elliptic or oblong-elliptic -----
 51. *A. anisopodium* Ledeb.
42. Compact-caespitose plants, not tall, 10—25 cm. high, with numerous almost cord-like roots. Bulbs feebly developed, c. 0.5 cm. thick, with envelopes split into parallel laciniae or into obscurely reticulate fibres ----- 43
- + Plants more robust, 30—100 cm. high, forming tufts or not forming them, or small caespitose plants, but never with numerous almost cord-like roots ----- 45

43. Bulb-envelopes split into almost reticulate fibres. Filaments of the inner stamens expanded, and more often bidentate, at the base -----47. *A. polyrrhizum* Turcz.
- + Bulb-envelopes split into parallel laciniae. Filaments of the inner stamens bidentate $2/3$ — $3/4$ of the way up ----- 44
44. Umbel hemispherical or spherical, dense. Pedicels equalling, or $1\frac{1}{2}$ times as long as, the perianth. Filaments slightly shorter than the perianth-segments. Leaves 1—1.5 mm. wide -----48. *A. bidentatum* Fisch.
- + Umbel hemispherical, lax, with almost pendulous flowers. Pedicels ($1\frac{1}{2}$)—2 times as long as the perianth. Filaments equalling the perianth-segments. Leaves c. 0.5 mm. wide --
49. *A. bellulum* Prokh.
45. Bulb-envelopes coriaceous ----- 46
- + Bulb-envelopes membranous, or almost coriaceous and then the leaves semicylindric, canaliculate, congregated at the base of the stem ----- 50
46. Filaments slightly longer than the perianth-segments. Perianth-segments linear-oblong, obtuse, rosy with a strong purple nerve, 4 mm. long. Umbel dense, capitate. Bulb 0.75—1 cm. thick, 2—3 cm. long, attached singly to an ascending rhizome, which is covered with the remains of the bulbs of past years -----58. *A. glaciale* Vved.
- + Filaments $1\frac{1}{2}$ —2 times as long as the perianth-segments. Bulbs 1—3 cm. thick, crowded a few together, or solitary and then the flowers greenish-yellow ----- 47
47. Perianth-segments greenish-yellow. Leaves 6—9, broadly linear, 5—20 mm. wide, gradually narrowed towards the apex. Bulb solitary -----53. *A. obliquum* L.
- + Perianth-segments rose. Leaves with almost parallel margins. Bulbs \pm crowded ----- 48
48. Bulb-envelopes not shining, entire. Filaments of the inner stamens twice as broad at the base as the outer ones. Leaves broadly linear, generally falcately recurved -----
55. *A. polyphyllum* Kar. et Kir.
- + Bulb-envelopes shining, cracking. Filaments almost equal at the base. Leaves narrow-linear, straight ----- 49
49. Pedicels $1/3$ shorter than or equalling the perianth. Perianth-segments pale-rosy-lilac with a darker strong nerve -----
57. *A. kaschianum* Regel

- + Pedicels $1\frac{1}{2}$ —2—(3) times as long as the perianth. Perianth-segments bright rose, with an inconspicuous nerve -----
56. *A. hymenorrhizum* Ledeb.
- 50. Perianth-segments linear-lanceolate or lanceolate, 6—8 mm. long, rose. Leaves broadly linear, flat -----
54. *A. platyspathum* Schrenk
- + Perianth-segments 3—6 mm. long, oblong, elliptic or ovate ----- 51
- 51. Leaves smooth, linear, flat or carinate. Flowers rose or rose-violet. Loosely caespitose plants, or bulbs attached singly to a rhizome ----- 52
- + Leaves scabrid, semicylindric, often almost filiform, or flattish and smooth and then the flowers white. Plants generally densely caespitose ----- 54
- 52. Filaments slightly or $\frac{1}{4}$ shorter than the perianth-segments. Perianth-segments acute. Leaves carinate --37. *A. angulosum* L.
- + Filaments slightly longer than or up to twice as long as the perianth-segments. Perianth-segments obtuse. Leaves flat ----- 53
- 53. Filaments $1\frac{1}{2}$ —2 times as long as the perianth-segments, the inner ones twice as broad, and usually bidentate, at the base -----45. *A. nutans* L.
- + Filaments slightly longer than or $1\frac{1}{2}$ times as long as the perianth-segments, the inner ones $1\frac{1}{2}$ times as broad, and entire, at the base -----44. *A. senescens* L.
- 54. Perianth-segments rose-violet or purple ----- 55
- + Perianth-segments white or yellow, sometimes with a rosy tinge ----- 57
- 55. Perianth-segments purple. Pedicels slightly shorter or slightly longer than the perianth. Leaves 2—4. -----
43. *A. tythocephalum* Roem. et. Schult.
- + Perianth-segments rose-violet. Pedicels 2—3 times as long as the perianth. Leaves 5—8 ----- 56
- 56. Style not exerted from the perianth. Perianth-segments broadly elliptic or ovate, almost entire ----42. *A. rubens* Schrad.
- + Style exerted from the perianth. Perianth-segments oblong or more rarely oblong-ovate, the inner ones \pm crenulate --
41. *A. prostratum* Trev.
- 57. Leaves filiform, 0.5—0.75 mm. wide. Perianth-segments yellowish, 3—4 mm. long, oblong-lanceolate or oblong. Pedi-

cels 2—3—(4) times as long as the perianth -----

39. *A. flavescens* Bess.

- + Leaves 0.75—2—(4) mm. wide. Perianth-segments white or yellow, sometimes with a rosy tinge, 4—5 mm. long, oblong, ovate or broadly elliptic. Pedicels $1\frac{1}{2}$ —2 times as long as the perianth -----

58

58. Perianth-segments white, flattish. Filaments equalling or scarcely longer than the perianth -----38. *A. albidum* Fisch.

- + Perianth-segments yellow. Leaves semicylindric. Filaments slightly longer than or $1\frac{1}{2}$ times as long as the perianth-segments -----40. *A. Stellerianum* Willd.

59. Segments of the almost spherical perianth greenish-whitish, sometimes dirty-purple on the back, 4—5 mm. long, obtuse. Style exserted from the perianth. Filaments $1\frac{1}{2}$ —2 times as long as the perianth-segments. Umbel spherical, many-flowered, dense. Leaves flat, broadly linear, 3—15 mm. wide. (C. Asia) -----

60

- + Perianth-segments rose, rose-violet, dirty-violet, yellow or yellowish or white and then the style and filaments not exserted from the perianth -----

61

60. Filaments entire, equal. Scape leafy up to half-way -----

5. *A. Drobovi* Vved.

- + Filaments of the inner stamens bidentate at the base, almost twice as broad as the outer ones. Scape clothed with leaf-sheaths at the base or for $\frac{1}{3}$ -----6. *A. oreoscordum* Vved.

61. Bulb-envelopes indistinctly reticulate-fibrous or coarsely reticulate-fibrous, or (the outermost ones) almost reticulate and then the spathe with a long beak. Filaments entire --

62

- + Bulb-envelopes clearly reticulate, or coarsely and obscure reticulate and then the filaments of the inner stamens with teeth at the base -----

67

62. Umbel capitate. Pedicels half as long as, more rarely slightly shorter than, the perianth, without bracteoles at the base. Leaves \pm falcately recurved. Small plant c. 10 cm. high.

46. *A. pumilum* Vved.

- + Umbel fasciculate or hemispherical. Pedicels usually equaling or $1\frac{1}{2}$ —2 times as long as the perianth, with bracteoles at the base -----

63

63. Filaments $\frac{1}{3}$ shorter than the perianth-segments. Perianth campanulate -----

64

- + Filaments slightly longer than or $1\frac{1}{2}$ times as long as the perianth-segments. Perianth hemispherical ----- 65
- 64. Filaments of the inner stamens gradually narrowed from the base to the apex, 3 times as broad as the outer ones -----
74. *A. teretifolium* Regel
- + Filaments abruptly subulate from a triangular base which in the inner ones is twice as broad -----75. *A. Korolkowi* Regel
- 65. Leaves flat, canaliculate, 4—5 mm. wide. Perianth-segments acute -----78. *A. daghestanicum* Grossh.
- + Leaves 0.5—2 mm. wide. Perianth-segments obtuse or with a short apiculus ----- 66
- 66. Leaves 0.5—1 mm. wide. Perianth-segments 4—5 mm. long. Pedicels $1\frac{1}{2}$ —2 times as long as the perianth -----
77. *A. gunibicum* Mishch.
- + Leaves 1—2 mm. wide. Perianth-segments 5—6 mm. long. Pedicels equalling or $1\frac{1}{2}$ times as long as the perianth ----
76. *A. Albovianum* Vved.
- 67. Filaments connate and adnate to the perianth at the extreme base ----- 68
- + Filaments connate and adnate to the perianth for $\frac{1}{4}$ — $\frac{1}{2}$, or for only $\frac{1}{5}$ — $\frac{1}{6}$ and then the perianth narrowly campanulate, (5)—7—10 mm. long ----- 83
- 68. Scape scabrid; sheaths often shaggy ----- 69
- + Scape smooth, sheaths smooth ----- 70
- 69. Perianth-segments yellow, oblong, obtuse, 4—6 mm. long ----
21. *A. scabriscapum* Boiss. et Kotschy
- + Perianth-segments reddish-violet, oblong-lanceolate, acute, more rarely obtuse, generally 7 mm. long -----
22. *A. trachyscordum* Vved.
- 70. Perianth-segments 2—3 mm. long. Umbel brittle, few-flowered, lax. Pedicels with numerous bracteoles at the base. Small plant, c. 15 cm. high -----20. *A. oreodictyum* Vved.
- + Perianth-segments (3.5)—4—7 mm. long. Umbel not brittle, dense or rather lax. Pedicels with numerous bracteoles -- 71
- 71. Perianth-segments greenish-yellowish or almost white, sometimes with a reddish tinge on the back. Filaments yellow -- 72
- + Flowers rose or rosy-lilac ----- 73

72. Leaves flat, with almost parallel margins. Perianth-segments greenish-yellow -----10. *A. flavidum* Ledeb.
- + Leaves semicylindric, canaliculate, fistular, narrowed towards the apex. Perianth-segments almost white -----
9. *A. leucocephalum* Turcz.
73. Leaves semicylindric, (0.5)—1—2 mm. wide ----- 74
- + Leaves flat, (1)—2—5 mm. wide ----- 75
74. Umbel hemispherical, \pm few-flowered, rather lax. Leaves congregated at the base of the scape. Filaments slightly longer than the perianth -----7. *A. Fischeri* Regel
- + Umbel generally spherical, dense, many-flowered. Scape clothed for $1/3$ with distant leaf-sheaths. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth -----
8. *A. clathratum* Ledeb.
75. Filaments slightly shorter than or up to $1\frac{1}{2}$ times as long as the perianth-segments, the inner ones entire or toothed at the base; base almost as long as broad; perianth-segments with a strong nerve ----- 76
- + Filaments 1.5—2 times as long as the perianth-segments ----- 79
76. Perianth-segments pale-rose with a purple nerve. Leaves 4—6, strongly crowded at the base of the stem, smooth. Style strongly exserted from the perianth -----
19. *A. oreoprasoides* Vved.
- + Perianth-segments rose or rose-purple. Leaves 2—4, scabrid on the margin. Scape clothed for $1/3$ with distant leaf-sheaths or sheaths \pm crowded at the base and then the flowers especially strongly coloured ----- 77
77. Style 5—6 mm. long, strongly exserted from the perianth; stigma scarcely thickened; pedicels slightly shorter than or equalling the perianth -----16. *A. amphibolum* Ledeb.
- + Style 2.5—3.5 mm. long, exserted from the perianth; pedicels equalling or $1\frac{1}{2}$ —2 times as long as the perianth ----- 78
78. Perianth-segments rose, darker on the back, oblong-lanceolate or oblong-linear; stigma scarcely thickened -----
15. *A. bogdoicola* Regel
- + Perianth-segments rose, elliptic or oblong-elliptic; stigma almost capitate -----14. *A. strictum* Schrad.
79. Pedicels scarcely more than half as long as, or slightly longer than, the perianth. Perianth-segments generally pale-rose, 5—7 mm. long ----- 80

- + Pedicels 1.5—2—3 times as long as the perianth. Perianth-segments rose, 3.5—4—(5) mm. long, or light-rosy-lilac and then not more than 4 mm long ----- 81
80. Perianth-segments (5)—6—7 mm. long, lanceolate or oblong-lanceolate. Bulb-envelopes clearly reticulate -----
17. *A. Szovitsi* Regel
- + Perianth-segments 5 mm. long, oblong or ovate. Bulb-envelopes coarsely and obscurely reticulate --18. *A. brachyodon* Boiss.
81. Perianth-segments rose with an inconspicuous nerve. Base of the inner filaments longer than broad -----13. *A. lineare* L.
- + Perianth-segments with a strong nerve. Base of the inner filaments as long as, or shorter than, broad ----- 82
82. Bulbs narrowly cylindro-conical. Perianth-segments 3.5—4 mm. long, light-rosy-lilac -----12. *A. splendens* Willd.
- + Bulbs ovoid-oblong. Perianth-segments 4—5 mm. long, rose
11. *A. Maackii* Prokh.
83. Leaves as well as sheaths (especially the lower sheaths) hairy.
Small plant 5—15 cm. high -----23. *A. gusaricum* Regel
- + Plant glabrous, generally more robust ----- 84
84. Perianth almost stellate or hemispherical; leaves congregated at the base of the scape ----- 85
- + Perianth campanulate or narrowly campanulate; leaves \pm distant ----- 86
85. Filaments of the inner stamens twice as broad at the base as the outer ones; bulb-envelopes strongly reticulate -----
35. *A. oreoprasum* Schrenk
- + Filaments almost equal; bulb-envelopes thin and comparatively obscurely reticulate -----36. *A. odorum* L.
86. Ovary provided with teeth at the apex forming a corona surrounding the base of the style ----- 87
- + Ovary without a corona of teeth at the apex ----- 88
87. Perianth-segments dirty-violet, unequal, the outer ones linear-lanceolate or lanceolate, $\frac{1}{4}$ longer than the lanceolate or oblong-lanceolate inner ones. Pedicels unequal, half as long as, or slightly (in fruit twice) longer than, the perianth --
33. *A. stephanophorum* Vved.
- + Perianth-segments bright deep-rose, almost equal, the outer ones oblong, the inner lanceolate. Pedicels almost equal, half as long as the perianth-segments ----34. *A. tenuicaule* Regel

88. Filaments equalling or slightly longer than the perianth-segments. Style (especially in fruit) exserted from the perianth ----- 89
- + Filaments $\frac{1}{2}$ — $\frac{2}{3}$ as long as the perianth. Style, even in fruit, not exserted from the perianth ----- 90
89. Umbel hemispherical or almost spherical, more rarely fasciculate-hemispherical. Pedicels equalling or $1\frac{1}{2}$ times (to twice) as long as the perianth. Anthers yellow -----
31. *A. dolichostylum* Vved.
- + Umbel fasciculate or fasciculate-hemispherical, more rarely hemispherical. Pedicels $\frac{1}{2}$ as long as, equalling, or (in fruit) $1\frac{1}{2}$ times as long as, the perianth-segments. Anthers violet -----32. *A. inderiense* Fisch.
90. Perianth-segments yellowish -----28. *A. lutescens* Vved.
+ Perianth-segments dirty-violet, rose-violet or violet, without a yellow tinge ----- 91
91. Perianth-segments dirty-violet or cinnamomeous-violet, darker on the back ----- 92
- + Perianth-segments pale-rose, rose, light-violet or violet, with a darker nerve ----- 93
92. Leaves 2—3, narrowly linear, often almost filiform, 0.5—1 mm. wide, canaliculate -----24. *A. inconspicuum* Vved.
+ Leaves 4—5, linear, 2.5—10 mm. wide, flat, falcately recurved -----25. *A. drepanophyllum* Vved.
93. Umbel spherical or hemispherical, very rarely fasciculate-hemispherical, lax. Pedicels ascending, 4—6 times as long as the perianth, or only (2)—3—4 times as long and then the perianth 5—7 mm. long ----- 94
- + Umbel fasciculate or hemispherical, dense. Pedicels $\frac{1}{2}$ as long as, equalling or more rarely 2—3 times as long as, the perianth. Perianth-segments 7—14 mm. long ----- 95
94. Leaves canaliculate, fistular, 1—3 mm. wide. Perianth-segments purple-violet, 7—9 mm. long. Pedicels 4—6 times as long as the perianth -----29. *A. longiradiatum* Vved.
+ Leaves flat, not fistular, falcately recurved, (1)—3—4 mm. wide. Perianth-segments generally pale-violet, 5—7 mm. long. Pedicels (2)—3—4 times as long as the perianth.
30. *A. dolichomischum* Vved.

95. Leaves flat, 3—5—(10) mm. wide, falcately recurved. Anthers usually violet -----26. *A. xiphopetalum* Aitch. et Baker
- + Leaves canaliculate, 1—3mm. wide. Anthers yellow -----
27. *A. Barszczewskii* Lipsky
96. Filaments of the inner stamens trifid at $1/3$ — $4/5$ of their height, with filiform lateral teeth exceeding in the majority of species the middle antheriferous one, in the minority shorter. Scape clothed with leaf-sheaths \pm high up in the aëriel part. (Sect. *Porrum*) ----- 97
- + Filaments entire or the inner ones bidentate; teeth never exceeding the anther, short, or \pm long but then situated at the base of the filament ----- 130
97. Small, generally stocky plants, 10—30 cm. high; leaves exceeding the umbel (C. Asia) ----- 98
- + Taller, slender plants, 30—70 (-100) cm. high, more rarely (generally stunted specimens) 15—30 cm.; leaves considerably shorter than the scape ----- 101
98. Outer bulb-envelopes papyraceous or almost coriaceous, without nerves. Bulblets absent, or almost smooth ----- 99
- + Outer bulb-envelopes reticulate or with reticulate venation. Bulblets with reticulate venation ----- 100
99. Middle tooth of the inner stamens $1/3$ as long as the base and $1/2$ — $2/3$ as long as the laterals; bulblets absent; perianth-segments 6—7 mm. long -----144. *A. Lehmannianum* Merckl.
- + Middle tooth of the inner stamens equalling or $1/3$ shorter than the base and slightly longer than or up to $1\frac{1}{2}$ times as long as the laterals. Bulblets dull, yellow, with a keel on the back. Perianth-segments 4—(6) mm. long -----
143. *A. ferganicum* Vved.
100. Middle tooth of the inner stamen $1/4$ — $1/3$ as long as the base. Scapes usually 2—(5) from one bulb ---145. *A. Borzczowi* Regel
- + Middle tooth of the inner stamens $1\frac{1}{2}$ —2 times as long as the base. Scape solitary -----146. *A. brevidens* Vved.
101. Outer bulb-envelopes reticulate or reticulate-nerved. Bulblets, if present, always yellowish, large ----- 102
- + Outer bulb-envelopes papyraceous or coriaceous, cracking, or sometimes bast-like at the apex with indistinct reticulation. Bulblets, if present, black-brown or black-violet, or yellow and then small ----- 107

102. Bulblets with reticulate venation, densely studded with crystalline tubercles -----148. *A. crystallinum* Vved.
- + Bulblets, if present, smooth or with reticulate venation, never with crystalline tubercles ----- 103
103. Bulb-envelopes reticulate or with reticulate venation, surrounding the scape for a comparatively short distance; bulblets always smooth (C. Asia) ----- 104
- + Bulb-envelopes numerous, very reticulate, surrounding the scape for some distance up. Bulblets absent, or with reticulate venation ----- 105
104. Perianth-segments rose-violet, 5—6 mm. long, linear-lanceolate, acute. Middle tooth of the inner stamens equalling the base and the lateral teeth ----147. *A. turcomanicum* Regel
- + Perianth-segments greenish (in the herbarium often rosy), 4—5 mm. long, oblong or oblong-obovate. Middle tooth of the inner stamens $\frac{1}{2}$ as long as the base and $\frac{2}{7}$ — $\frac{2}{3}$ as long as the laterals -----149. *A. filidens* Regel
105. Leaves not fistular, linear, canaliculate, congregated at the base of the scape. Perianth-segments whitish, scabrid, 5—6 mm. long. Style not exserted from the perianth -----
150. *A. dictyoscordum* Vved.
- + Leaves fistular, narrowing towards the apex. Perianth-segments 3—5 mm. long, dull-green, white-edged on the margin, dark-purple or brown-green, smooth ----- 106
106. Leaves 6—11 mm. wide. Perianth-segments dull-green, white-edged on the margin. Filaments glabrous, more rarely sparsely ciliate -----151. *A. viride* Grossh.
- + Leaves 3—5 mm. wide. Perianth-segments dark-purple or brown-green. Filaments slightly ciliate -----
152. *A. dictyoprasum* C. A. Mey.
107. Segments of the tubular-campanulate perianth 7—9 mm. long -----154. *A. Aucheri* Boiss.
- + Perianth-segments 4—5 mm. long ----- 108
108. Leaves fistular. Style exserted from the perianth ----- 109
- + Leaves not fistular, linear, canaliculate ----- 115
109. Umbel generally with bulbils -----153. *A. vineale* L.
- + Umbel without bulbils ----- 110

110. Perianth narrowly campanulate, whitish or with a blotch on the segments. Filaments of the inner stamens broader than the perianth-segments at the base ----- 111
- + Perianth oblong-ovoid or ovoid, generally vinaceous-red or purple. Filaments of the inner stamens equalling the perianth-segments at the base ----- 112
111. Perianth 4 mm. long, whitish, without blotches on the segments. Filaments ciliate -----156. *A. affine* Ledeb.
- + Perianth 2.5 mm. long, whitish, with a small blotch on the segments. Filaments glabrous -----155. *A. guttatum* Stev.
112. Bulb-envelopes coriaceous, hard. Bulblets yellowish-brown, finely tuberculate. Leaves cylindric. Perianth 3.5 mm. long, vinaceous-red, with the outer segments scabrid on the keel --
157. *A. firmo-tunicatum* Fom.
- + Bulb-envelopes papyraceous or coriaceous. Bulblets yellowish and smooth, or yellowish-brown or brown and matt, owing to the prominent nerves, and then the leaves semicylindric, canaliculate. Perianth c. 4mm. long, rose or more often dark purple, very rarely whitish ----- 113
113. Bulblets yellowish-brown or more often brown, numerous. Middle tooth of the inner filaments $\frac{1}{3}$ — $\frac{1}{2}$ as long as the base. Pedicels smooth -----160. *A. Regelianum* Beck.
- + Bulblets yellowish, few. Middle tooth of the inner filaments $\frac{1}{2}$ — $\frac{2}{3}$ as long as the base. Pedicels scabrid beneath the flower ----- 114
114. Perianth-segments scabrid. Leaves usually smooth. Bracteoles few -----159. *A. sphaerocephalon* L.
- + Perianth-segments smooth. Leaves usually scabrid. Bracteoles numerous -----158. *A. fusco-violaceum* Fom.
115. Umbel with bulbils ----- 116
- + Umbel without bulbils ----- 118
116. Perianth-segments 5 mm. long, scabrid. Leaves scarcely exceeding the middle of the scape -----161. *A. Scorodoprasum* L.
- + Perianth-segments 3 mm. long, smooth. Leaves considerably exceeding the middle of the scape ----- 117
117. Filaments at the end of flowering up to $1\frac{1}{2}$ times as long as the perianth-segments; wild plant ----162. *A. longicuspis* Regel
- + Filaments shorter than the perianth-segments; cultivated plant -----163. *A. sativum* L.

118. Bulblets and envelopes of the new bulb black-brown, black-violet or brown-purple ----- 119
- + Bulblets and envelopes of the new bulb yellowish ----- 125
119. Perianth spherical-campanulate. Filaments equalling or more rarely slightly shorter than the perianth-segments. Capsule equalling the perianth ----- 120
- + Perianth campanulate, ovoid-campanulate or ovoid-pyramidal. Filaments $\frac{1}{4}$ or $\frac{1}{3}$ shorter than the perianth-segments 122
120. Perianth-segments light-rose --166. *A. gracilescens* Somm. et Lev.
- + Perianth-segments whitish, sometimes \pm purple on the back, or dark-purple ----- 121
121. Perianth-segments whitish, sometimes \pm purple on the back
164. *A. Fominianum* Mishch.
- + Perianth-segments dark-purple -----165. *A. ponticum* Mishch.
122. Segments of the campanulate perianth lanceolate, acute, rose-coloured -----167. *A. erubescens* C. Koch
- + Perianth-segments broader, oblong, ovate or elliptic, at least the inner ones obtuse or subobtuse ----- 123
123. Segments of the broadly campanulate perianth obtuse, the outer ones dark-purple, the inner elliptic, usually almost white with a purple nerve -----168. *A. rotundum* L.
- + Segments of the ovoid-campanulate or ovoid-pyramidal perianth \pm uniformly coloured, the inner ones oblong-ovate -- 123
124. Perianth-segments rose-violet. Umbel usually almost capitate
169. *A. jajlae* Vved.
- + Perianth-segments dark-purple-violet --170. *A. Waldsteini* G. Don
125. Scape 15—30 cm. high. Filaments slightly shorter than the perianth-segments. Perianth-segments almost white, 5 mm. long, acute, strongly scabrid. Style not exerted from the perianth -----171. *A. talyschense* Mishch.

- + Scape 50—120 cm. high; filaments scarcely longer than or up to twice as long as the perianth; style exerted from the perianth ----- 126
- 126. Filaments $1\frac{1}{4}$ times or up to twice as long as the perianth-segments; perianth-segments 3—4 mm. long ----- 127
- + Filaments scarcely longer than the perianth; segments 5 mm. long ----- 129
- 127. Middle tooth of the inner filaments equalling the base and scarcely longer than the laterals; perianth-segments lanceolate or oblong-lanceolate, acute, rose-coloured -----
172. *A. pseudo-ampeloprasum* Mishch.
- + Middle tooth $\frac{1}{2}$ — $\frac{2}{3}$ as long as the base and the lateral teeth; perianth-segments elliptic, oblong-ovate or ovate, obtuse or subacute, white, dirty-green or dark-purple-violet ----- 128
- 128. Perianth-segments white -----128. *A. leucanthum* C. Koch
- + Perianth-segments dark-purple-violet, more rarely dirty-green -----173. *A. atro-violaceum* Boiss.
- 129. Perennial wild plant; scape ascending laterally from the bulb
175. *A. Ampeloprasum* L.
- + Biennial cultivated plant; scape issuing from the centre of the bulb -----176. *A. Porrum* L.
- 130. Scape [*sphalm.* "style"] clothed with leaf-sheaths \pm high up in the aërial part. Leaves filiform, semicylindric, or cylindric, more rarely flat; fistular or not fistular. (Sect. *Haplostemon*) ----- 131
- + Scape clothed with leaf-sheaths in the underground part; more rarely the sheaths clothe the scapes in the aërial part and then the leaves are loriform. Leaves never fistular, linear, linear-lanceolate, loriform, oblong to elliptic ----- 179
- 131 Umbel fasciculate or fasciculate-hemispherical, as it were two-tiered, owing to the, at the time of flowering, cernuous or pendulous flowers and erect fruiting pedicels. Spathe tearing into two long-acuminate portions, the longer of which is generally considerably longer than the umbel (cf. *A. karsianum*), and the beak of which equals, or more often several times exceeds, the base of the spathe. Bulb-envelopes papyraceous or almost coriaceous, never reticulate or reticulate-fibrous ----- 132
- + Umbel fasciculate, hemispherical, sometimes almost capitate, with flowers not cernuous or pendulous, or pendulous and

- then the bulb-envelopes reticulate or reticulate-fibrous. Spathe coming away entire, with a short or long beak; or tearing, with a short beak, or sometimes with a long beak up to 3 times exceeding the base of the spathe (cf. *A. delicatulum*) ----- 143
132. Flowers pearly-white; capsule slightly longer than the perianth ----- 110. *A. convallarioides* Grossh.
- + Flowers coloured; capsule slightly shorter than or almost equalling the perianth ----- 133
133. Perianth-segments dull owing to the deterrent "bloom". Filaments $1\frac{1}{2}$ —2 times as long as the perianth-segments. Ovary oblong on a short stipe ----- 134
- + Perianth-segments without "bloom," shining or not shining 135
134. Flowers yellowish with a \pm intense rose tinge, dirtyish. Umbel without bulbils ----- 102. *A. pulchellum* G. Don
- + Flowers rose. Umbel with bulbils ----- 103. *A. carinatum* L.
135. Perianth-segments 3—4 mm. long. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times (to twice) as long as the perianth-segments ----- 136
- + Perianth-segments 5—8 mm. long. Filaments slightly shorter or scarcely longer than the perianth-segments ----- 138
136. Perianth-segments whitish-greenish with a violet blotch ---- 100. *A. kossoricum* Fom.
- + Perianth-segments yellow or rose ----- 137
137. Perianth-segments yellow, more rarely with a violet tinge. Outer bulb-envelopes almost coriaceous, with distinct parallel nerves; envelopes of the new bulb with distinct parallel nerves ----- 101. *A. pseudo-flavum* Vved.
- + Perianth-segments rose without any trace of yellow tint. Outer bulb-envelopes papyraceous, almost without nerves; envelopes of the new bulb without noticeable nerves ---- 99. *A. stamineum* Boiss.
138. Umbel with bulbils ----- 104. *A. oleraceum* L.
- + Umbel without bulbils ----- 139
139. Pedicels almost equal, slightly shorter than or 2—(3) times as long as the perianth ----- 140
- + Pedicels very unequal, the longest not less than 3 times as long as the shortest, (1)—2—9 times as long as the perianth -- 141

140. Perianth-segments pale-rose, almost white with a purple nerve, not shining, 5—6 mm. long. Filaments equalling the perianth or slightly longer than it -----109. *A. rupestre* Stev.
- + Perianth-segments rose or more often deep-rose with a purple nerve, shining, (6)—7—8 mm. long. Filaments slightly or $\frac{1}{4}$ shorter than the perianth-segments -----108. *A. Kunthianum* Vved.
141. Perianth-segments pale-rose, almost white, obtuse, with a rounded apex, (6)—7—8 mm. long ----107. *A. karsianum* Fom.
- + Perianth-segments rose, sometimes deep-rose or dirty-rose, obtuse with a truncate or almost truncate apex, 5—6 mm. long ----- 142
142. Perianth-segments shining, bright-rose or deep-rose, at any rate at the time of flowering -----105. *A. paniculatum* L.
- + Perianth-segments, even at the time of flowering, insignificant, dirty-rose, dull -----106. *A. lenkoranicum* Mishch.
143. Outer bulb-envelopes reticulate, reticulate-fibrous or with reticulate venation, or coriaceous and indistinctly reticulate-nerved, or almost papyraceous with almost parallel nerves, but in any case with conspicuously prominent closely arranged nerves and the bulblets then with evident nerves -- 144
- + Outer bulb-envelopes papyraceous or coriaceous, without conspicuous nerves, or with distant clearly parallel nerves and the bulblets then foveolate. Bulblets, if present, always without nerves ----- 159
144. Filaments connate and adnate to the perianth at the base -- 145
- + Filaments connate and adnate to the perianth for $\frac{1}{3}$ — $\frac{1}{2}$, or for $\frac{1}{4}$ and then the spathe coming away entire, caducous -- 150
145. Leaves cylindric, fistular, spirally (almost helicoidally) twisted. Bulblets few -----122. *A. ophiophyllum* Vved.
- + Leaves filiform, canaliculate, never spirally coiled. Bulblets absent ----- 146
146. Inner perianth-segments \pm deeply incised in the apical portion, the outer ones entire -----98. *A. lacerum* Freyn
- + All the perianth-segments entire ----- 147
147. Bulb-envelopes reticulate; lower sheaths \pm pilose -----97. *A. callidictyum* C. A. Mey.
- + Bulb-envelopes coriaceous, cracking or (in some) \pm reticulate-fibrous; leaves glabrous, smooth ----- 148

148. Spathe at the base forming a tube surrounding the base of the umbel. Ovary almost spherical. Bulb-envelopes coriaceous, cracking, with almost reticulate nerves -----
94. *A. Margaritae* B. Fedch.
- + Spathe lacerate to the base. Ovary truncate-conical or pyriform. Envelopes almost coriaceous, cracking, \pm reticulate-fibrous ----- 149
149. Pedicels very unequal, (2)—3—6—(10) times as long as the perianth. Perianth-segments 4—5—(7) mm. long; leaves withering towards flowering-time -----95. *A. inaequale* Janka
- + Pedicels almost equal, equalling or 2—(3) times as long as the perianth. Perianth-segments (5)—6—7 mm. long; leaves lasting almost until fruiting-time -----
96. *A. moschatum* L.
150. Perianth-segments light-flesh-pink, the inner ones with a fovea at the base, up to 1/3 shorter than the outer ones ----
121. *A. Griffithianum* Boiss.
- + Perianth-segments white, rose or deep-rose, the inner ones without a fovea at the base. Perianth umbilcate at the base. (*A. rubellum* s. l.) ----- 151
151. Spathe coming away entire, caducous ----- 152
- + Spathe becoming torn to the base, persistent ----- 157
152. Segments of the broadly campanulate perianth 3—5—(6) mm. long. Filaments slightly or up to 1/3 shorter than the perianth-segments. Capsule slightly shorter than the perianth - 153
- + Segments of the campanulate or narrowly campanulate perianth (4)—5—7 mm. long. Filaments 1/3—2/3 as long as the perianth-segments. Capsule 1/2—2/3 as long as the perianth ----- 155
153. Outer bulb-envelopes coriaceous, often reticulate-fibrous. Bulbs with reticulate venation. Spathe with a beak usually exceeding the base of the spathe. Perianth-segments 4—5—(6) mm. long -----122. *A. fibrosum* Regel
- + Outer bulb-envelopes coriaceous, with almost reticulate venation. Bulblets generally winged, with slender nerves. Perianth-segments 3—4—(5) mm. long ----- 154
154. Perianth-segments deep-rose, linear-oblong, obtuse -----
113. *A. syntamanthum* C. Koch
- + Perianth-segments rose, oblong or oblong-lanceolate, attenuate, acute or subotuse -----114. *A. rubellum* M. Bieb., s. s.

155. Outer bulb-envelopes greyish, almost papyraceous, with almost parallel nerves. Bulblets whitish, with slender nerves -----117. *A. Jacquemontii* Kunth
- + Outer bulb-envelopes brown, coriaceous, with almost reticulate nerves, and sometimes bast-like. Bulblets yellowish or brownish ----- 156
156. Bulblets few, with slender nerves. Filaments of the inner stamens equalling the perianth-segments at the base ----
----- 115. *A. albanum* Grossh.
- + Bulblets usually numerous, with thick reticulate nerves, often with distinct cells between the nerves. Filaments of the inner stamens usually slightly broader at the base than the perianth-segments -----116. *A. scabrellum* Boiss. et Buhse
157. Perianth-segments rose, [the outer ones] $1\frac{1}{4}$ or more often $1\frac{1}{2}$ times as long as the inner -----118. *A. anisotepalum* Vved.
- + Perianth-segments white, equal, or the outer ones slightly longer than the inner ----- 158
158. Segments of the broadly campanulate perianth oblong or rarely oblong-lanceolate, generally shortly acuminate, the outer ones generally slightly shorter than the inner -----
119. *A. minutum* Vved.
- + Segments of the campanulate perianth oblong-lanceolate or lanceolate, very attenuate, equal -----120. *A. parvulum* Vved.
159. Perianth purple, 8—10 mm. long. Leaf solitary. Whole plant scabrid -----135. *A. kujukense* Vved.
- + Perianth 3—7 mm. long. Leaves 2—4. Plants (at any rate the scapes) smooth, or, if the scape is scabrid, the filaments of the inner stamens bidentate ----- 160
160. Outer bulb-envelopes coriaceous, foveolate, or with cristate outgrowths, or striate owing to the impressed distant nerves, or sometimes smooth, but the bulblets always tuberculate-foveolate ----- 161
- + Outer bulb-envelopes papyraceous, smooth. Bulblets absent or smooth ----- 166
161. Filaments of the inner stamens triangular, 3 times as broad at the base as the outer ones. Perianth-segments (5)—6—7 mm. long ----- 136. *A. eremoprasum* Vved.
- + Filaments subulate, equal. Perianth-segments c. 3 mm. long 162

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162. Outer perianth-segments scabrid -----	163
+ Perianth-segments smooth -----	164
163. Perianth-segments greenish, obtuse. Bulb-envelopes striate owing to the impressed distant nerves. Scape thick, as it were slantingly inflated -----	141. <i>A. sabulosum</i> Stev.
+ Perianth-segments cinnamomeous, in the herbarium with a violet tinge, acute. Scape slender ----	138. <i>A. confragosum</i> Vved.
164. Outer bulb-envelopes without cristate outgrowths, foveolate, blackish or brownish. Plant stocky, generally with a thickish scape 10—20 cm. high -----	139. <i>A. scrobiculatum</i> Vved.
+ Outer bulb-envelopes, at least in young (sterile) examples, with longitudinal crests, light-brownish. Scape (15)—20—60 cm. high, slender -----	165
165. Perianth-segments light lilac, obtuse -----	140. <i>A. transvestiens</i> Vved.
+ Perianth-segments whitish with a dirty-purple nerve, acute -----	137. <i>A. Popovii</i> Vved.
166. Filaments of the inner stamens 2—3 times as broad as the outer ones at the base -----	167
+ Filaments equal at the base, or the inner ones up to 1½ times broader, generally without teeth -----	174
167. Perianth-segments c. 3 mm. long, obtuse, rose-coloured, not shining; leaves flat from the base, narrowed towards the apex, 2—10 mm. wide. Robust plant (40)—70—100 cm. high, with a bulb 1.5—3 cm. thick -----	142. <i>A. turkestanicum</i> Regel
+ Perianth-segments 4—8 mm. long. Scape not above 40 cm. in height, or if more, flowers azure or dark-blue-azure ----	168
168. Uppermost sheath inflated at the apex. Flowers shining, rose-coloured, in a dense almost capitate umbel. Pedicels ½ as long as, equalling, or (in fruit) up to 1½ times as long as, the perianth. Filaments of the inner stamens bidentate --	134. <i>A. schoenoprasoides</i> Regel
+ Sheaths not inflated. Pedicels not less than twice as long as the perianth, or, if equal or 1½ times as long, then the filaments edentate -----	169
169. Perianth-segments azure or dark-blue-azure, or blue-violet, or white when alive and light-violet in the herbarium -----	170

- + Perianth-segments rose with a purple nerve. Small plants,
not above 20 cm. high ----- 172
- 170. Perianth-segments in the living state white, in the herbarium
light-violet, 5—6 mm. long. Slender plant, 10—20 cm. high,
with a lax umbel with ascending outer pedicels -----
131. *A. elegans* Drob.
- + Perianth-segments azure, dark-blue-azure or blue-violet.
Coarser plants, (15)—30—80 cm. high, with a dense umbel 171
- 171. Leaves semicylindric, canaliculate. Perianth campanulate.
Filaments of the inner stamens \pm bidentate at $2/3$ of their
height -----130. *A. caesium* Schrenk
- + Leaves triquetrous, canaliculate. Perianth broadly campanu-
late. Filaments of the inner stamens without teeth or bi-
dentate below the middle -----129. *A. caeruleum* Pall.
- 172. Perianth-segments 4—5 mm. long. Filaments of the inner
stamens bidentate -----133. *A. oreophiloides* Regel
- + Perianth-segments 6—7 mm. long. Filaments without teeth 173
- 173. Pedicels 2—3 times as long as the perianth, with bracteoles
at the base. Spathe caducous -----123. *A. inops* Vved.
- + Pedicels equalling or $1\frac{1}{2}$ times as long as the perianth.
Spathe persistent -----132. *A. kopetdagense* Vved.
- 174. Pedicels 3—5 times as long as the perianth. Umbel few-
flowered, lax. Filaments slightly or up to $1/3$ shorter than
the perianth. Spathe several times shorter than the umbel,
very shortly acuminate -----111. *A. kirindicum* Bornm.
- + Pedicels slightly shorter than or $1\frac{1}{2}$ —2 times as long as the
perianth, or up to 4 times as long as the perianth and then
the umbel dense, spherical, and either the filaments longer
than the perianth or the spathe with a long beak ----- 175
- 175. Filaments up to $1\frac{1}{2}$ times as long as the perianth-segments,
more rarely equalling them and then the spathe shortly
acuminate ----- 176
- + Filaments $1/4$ shorter than the perianth-segments, or equalling
them and then the spathe with a long beak at least half as
long as the base of the spathe ----- 177
- 176. Perianth-segments rose-coloured, shining, 3—4 mm. long,
lanceolate or oblong-lanceolate. Umbel always without bulb-
lets -----127. *A. Pallasii* Murr.

- + Perianth-segments deep-rose, (4)—5 mm. long, comparatively dull, oblong or oblong-lanceolate. Umbel usually with bulblets, more rarely without them -----
128. *A. macrostemon* Bunge
- 177. Sheaths densely short-hairy. Perianth-segments 6—7 mm. long. Style not exserted from the perianth -----
124. *A. lasiophyllum* Vved.
- + Sheaths glabrous, smooth or more rarely scabrid. Style scarcely exserted from the perianth ----- 178
- 178. Pedicels usually 2—3 times as long as the perianth. Perianth-segments whitish or rosy ----125. *A. delicatulum* Sievers
- + Pedicels slightly shorter than or equalling the perianth. Perianth-segments rose-violet -----126. *A. glomeratum* Prokh.
- 179. Pedicels with large bracteoles at the base. Filaments adnate to the perianth half-way. (Sect. *Caloscordum*) -----
226. *A. neriniflorum* Baker
- + Pedicels without bracteoles at the base (Sect. *Molium*) ---- 180
- 180. Perianth-segments soon reflexed, withering after flowering, \pm twisted ----- 181
- + Perianth-segments usually not withering after flowering, not twisted, usually pointing upwards ----- 207
- 181. Ovary with 7—10 ovules. Umbel lax. Pedicels 3 or many times as long as the perianth. Perianth-segments 4—5 mm. long. Small plants with scape 10—20 cm. high ----- 182
- + Ovary with many ovules ----- 186
- 182. Leaves divided to the base into filiform segments, forming a false whorl -----185. *A. verticillatum* Regel
- + Leaves entire ----- 183
- 183. Spathe with a long herbaceous beak. Bulb-envelopes coriaceous -----186. *A. aroides* Vved.
- + Spathe shortly acuminate. Bulb-envelopes papyraceous -- 184
- 184. Scape thick, 5—8 mm. thick. Pedicels thick, clavately thickened beneath the flower. Perianth-segments 5 mm. long --
182. *A. helicophyllum* Vved.
- + Scape slender, c. 1.5 mm. thick. Pedicels slender, not thickened beneath the flower. Perianth-segments 4 mm. long 185
- 185. Leaves straight, pilose beneath in the lower half together with the upper part of the sheaths -----184. *A. Eugeniei* Vved.

- + Leaves twisted [*sphalm.* 'crowded'], glabrous ----- 183. *A. Sergii* Vved.
186. Plants stocky, 10—25 cm. high, with a thick scape buried half-way or more in the ground. Leaves considerably exceeding the umbel ----- 187
- + Plants generally taller, with the scape buried in the ground at the base. Leaves shorter than the scape ----- 188
187. Leaves linear-lanceolate or narrowly lanceolate, 1—2 cm. wide ----- 194. *A. brachyscapum* Vved.
- + Leaves lanceolate or more often oblong or almost elliptic, (3)—5—12 cm. wide ----- 195. *A. karataviense* Regel
188. Ovary with 6 cornicles. Filaments clearly united into a ring above their point of adnation to the perianth ----- 189
- + Ovary without cornicles ----- 190
189. Perianth-segments gradually narrowed from the base to the apex, deep-rose-violet. Umbel rather lax ----- 214. *A. sarawschanicum* Regel
- + Perianth-segments narrowed from the middle to the apex, light-rose-violet. Umbel more compressed, dense ----- 215. *A. pseudo-seravschanicum* M. Pop. et Vved.
190. Perianth-segments white with a green nerve, 11 mm. long, filiform-linear, gradually narrowed from the base to the apex. Robust plant, 90—150 cm. high ----- 208. *A. gulczense* B. Fedch.
- + Perianth-segments rose, rose-violet, violet or vinaceous-red, or white and then 4 mm. long ----- 191
191. Perianth-segments rose-violet, delicate, with an inconspicuous nerve, 5—7 mm. long. Filaments of the inner stamens generally with teeth at the base ----- 198. *A. Fetisowi* Regel
- + Perianth-segments with a conspicuous nerve ----- 192
192. Leaves, and sometimes also the scape, pubescent ----- 193
- + Glabrous plants ----- 195
193. Robust plant 60—150 cm. high. Perianth-segments lilac, 9 mm. long ----- 207. *A. stipitatum* Regel
- + Scape 15—70 cm. high. Perianth-segments 4—6 mm. long ----- 194
194. Perianth-segments 6 mm. long, light-violet. Pubescence long-pilose ----- 206. *A. alaicum* Vved.
- + Perianth-segments 4 mm. long, white. Pubescence short, scabrous ----- 199. *A. dasyphyllum* Vved.

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195. Perianth-segments 3—5 mm. long -----	196
+ Perianth-segments 6—12 mm. long -----	202
196. Perianth-segments dark-purple or vinaceous-red -----	197
+ Perianth-segments pale-rose or rose-violet -----	199
197. Perianth-segments 5 mm. long, dark-purple -----	
201. <i>A. robustum</i> Kar. et Kir.	
+ Perianth-segments 3—4 mm. long, vinaceous-red -----	198
198. Filaments scarcely shorter than the perianth-segments, the inner ones obtusely bidentate above the middle -----	
197. <i>A. cardiostemon</i> Fisch. et Mey.	
+ Filaments entire, slightly longer than the perianth-segments	
196. <i>A. Mariae</i> *Bordz.	
199. Filaments almost equal at the base -----	200
+ Filaments of the inner stamens twice as broad at the base as the outer ones -----	201
200. Small plant 20—30 cm. high. Leaves 1—2 mm. wide -----	
200. <i>A. insufficiens</i> Vved.	
+ Fairly robust plant 35—85 cm. high. Leaves 5—20 mm. wide -----	204. <i>A. Suworowi</i> Regel
201. Perianth-segments linear -----	203. <i>A. Sewerzowi</i> Regel
+ Perianth-segments narrowly elliptic. ---	202. <i>A. decipiens</i> Vved.
202. Leaves broadly lanceolate or oblong, 4—8 cm. wide. Scape 30—50 cm. high. Perianth-segments 6 mm. long -----	
213. <i>A. Komarovii</i> Lipsky	
+ Leaves linear-lanceolate or loriform. Plants more robust, 70— 150 cm. high, or comparatively small (20—40 cm.) and then the perianth-segments 8—12 mm. long -----	203
203. Perianth-segments white-rose -----	205. <i>A. grande</i> Lipsky
+ Perianth-segments light or dark-violet -----	204
204. Scape 20—70 cm. high, ribbed owing to the strongly project- ing nerves -----	205
+ Scape 80—150 cm. high, with feebly prominent nerves ----	206
205. Perianth-segments dark-violet, gradually narrowed from the base to the apex, acute -----	212. <i>A. Rosenbachianum</i> Regel
+ Perianth-segments deep-rose-violet, with almost parallel margins, obtuse -----	211. <i>A. taeniopetalum</i> M. Pop. et Vved.

206. Scape above ground clothed with leaf-sheaths. Leaves glaucous, 6—8. Anthers violet. Filaments free above their point of adnation to the perianth ----- 209. *A. aflatunense* B. Fedch.
- + Scape above ground not clothed with leaf-sheaths. Leaves \pm green, 4—6. Anthers yellow. Filaments \pm united above their adnation to the perianth ----- 210. *A. altissimum* Regel
207. Perianth-segments after flowering rigid, sometimes almost spinose, owing to the thickening of the nerve ----- 208
- + Nerve of the perianth-segments not thickening after flowering. Perianth-segments not spinose ----- 214
208. Scape buried in the ground half-way or almost up to the umbel. Leaves 1—3 ----- 209
- + Scape buried in the ground only at the base. Leaves 2—7 --- 212
209. Perianth-segments 5—6 mm. long. Scape buried in the ground almost up to the umbel. Leaf 1 ----- 209. *A. monophyllum* Vved.
- + Perianth-segments 7—13 mm. long. Scape buried in the ground half-way. Leaves (1)—2—3 ----- 210
210. Leaves linear-lanceolate, 0.5—1 cm. wide. Perianth-segments white with a violet nerve. Filaments $1/3$ — $1/2$ as long as the perianth-segments ----- 188. *A. Derderianum* Regel
- + Leaves linear to elliptic, 2—6 cm. wide. Perianth-segments rose with a darker nerve. Filaments slightly shorter than or $1/2$ as long as the perianth-segments ----- 211
211. Filaments slightly or $1/3$ shorter than the perianth-segments 189. *A. Alexeianum* Regel
- + Filaments $1/2$ as long as the perianth-segments ----- 190. *A. Akaka* Gmel.
212. Perianth-segments 5—9 mm. long, lilac with a reddish nerve. Leaves glabrous ----- 191. *A. materculae* Bordz.
- + Perianth-segments 10—18 mm. long, rose-violet or purple-violet ----- 213
213. Leaves 1—2—(4), linear-lanceolate, recurved, stiffly ciliate, glabrous, or scabrid beneath. Scape comparatively slender, not more than 4—(5) mm. thick ----- 193. *A. Bodeanum* Regel
- + Leaves 3—7, almost loriform, erect, with stiff patent hairs beneath and on the margin, more rarely almost glabrous. Scape thick, 5—15 mm. thick ----- 192. *A. Christophi* Trautv.

214. Pedicels clavately thickened beneath the flower (especially in fruit), usually very unequal, forming as it were two spheres in the umbel. Umbel very lax, with fertile and sterile flowers -----219. *A. Schubertii* Zucc.

+ Pedicels never clavately thickened beneath the flower ---- 215

215. Ovary with 6 ovules ----- 216

+ Ovary with numerous ovules ----- 220

216. Ovary 1—2—(3)—flowered; perianth-segments rose, 4—5 mm. long -----177. *A. monanthum* Maxim.

+ Umbel usually with a large number of flowers; perianth-segments 8—12 mm. long ----- 217

217. Flower white, sometimes with a rosy tinge; leaves shorter or slightly longer than the scape; scape buried in the ground at the base; umbel sometimes with bulbils ----- 218

+ Flowers rose-purple or dirty-purple; leaves considerably exceeding the umbel; scape buried in the ground for 1/2—3/4 - 219

218. Scape triquetrous. Leaf solitary, 0.5—2.5 cm. wide -----
178. *A. paradoxum* (M. Bied.) G. Don

+ Scape terete. Leaves 2—3, 3—7 mm. wide -----
179. *A. Candolleanum* Albov

219. Segments of the broadly campanulate perianth bright rose-purple, oval -----180. *A. oreophilum* C. A. Mey.

+ Segments of the campanulate perianth dirty-purple, strongly coloured at the apex, oblong-linear or oblanceolate -----
181. *A. gypsaceum* M. Pop. et Vved.

220. Filaments 2/5—1/2 as long as the perianth-segments, connate and adnate to the perianth for 1/2—2/3, sometimes united up to half-way in the free part. Perianth narrowly campanulate ----- 221

+ Filaments slightly shorter than, or up to 1 1/2—2 times as long as, the perianth-segments, connate and adnate to the perianth at the base. Perianth stellate or campanulate -- 225

221. Perianth-segments not withering after flowering, erect -----
225. *A. iliense* Regel

+ Perianth-segments withering after flowering ----- 222

222. Filaments united up to half-way above their point of adnation to the perianth; umbel lax ----- 223
- + Filaments almost free above their adnation to the perianth; umbel dense ----- 224
223. Umbels usually 2—3—(4) on one scape, arranged one above the other, more rarely umbel solitary ---- 224. *A. Regeli* Trautv.
- + Umbel always 1 ----- 223. *A. cupuliferum* Regel
224. Flowers rosy-violet ----- 222. *A. Winklerianum* Regel
- + Flowers white ----- 221. *A. darwasicum* Regel
225. Perianth campanulate. Stocky plant with a scape 10—30 cm. high ----- 220. *A. caspium* (Pall.) M. Bieb.
- + Perianth stellate. Scape 50—150 cm. high ----- 226
226. Pedicels at the base immersed in the thickened spongy apex of the scape. Perianth-segments almost coriaceous after flowering. Filaments slightly shorter than the perianth-segments ----- 218. *A. Trautvetterianum* Regel
- + Pedicels not immersed at the base. Perianth-segments thin after flowering. Filaments slightly longer than or up to $1\frac{1}{2}$ times as long as the perianth-segments ----- 227
227. Perianth-segments elliptic, 5 mm. long, obtuse. Filaments almost $1\frac{1}{2}$ times as long as the perianth-segments ----- 217. *A. giganteum* Regel
- + Perianth-segments linear-lanceolate, 6—8 mm. long. Filaments slightly longer than the perianth-segments ----- 216. *A. elatum* Regel

Section 1. ANGUINUM G. Don, Mon. (1827) 96. —Bulb attached to a rhizome. Leaf-sheaths clothing the scape high up in the aerial part. Spathe persistent. Perianth-segments with one nerve. Filaments entire. Capsule 3-seeded. Seeds globose. [Sp. 1.]

1. *A. VICTORIALIS* Linné, Sp. Pl. (1753) 295; Ledeb. Fl. Ross. IV (1852) 184; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2(1854) 127; Boiss. Fl. Or. V (1882) 245; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. [Western] Sib. III (1929) 629; Kom. Oprod. Rast. Dalnevost. Kraya [Key Pl. Far Eastern Region] I (1931) 365. —*A. microdictyum* Prokhanov in Tr. Prikl. Bot. [Bull. Appl. Bot., Leningrad] XXIV, 2 (1930) 174. —*A. ochotense* Prokhanov, l. c. —*A. latissimum* Prokhanov l. c. —Ic. Kom., I. c., tab. 112, fig. 1. —Exs.: Billot, Fl. Gall. et German. exs. no. 2543.

Bulbs 1-few together, attached to an oblique rhizome, cylindro-conical, 1-1.5-(2) cm. thick, with light brown or greyish-brown reticulate envelopes. Scape 30-70 cm. high, clothed for $\frac{1}{3}$ to $\frac{1}{2}$ with smooth, often violet-tinted leaf-sheaths. Leaves 2-3, smooth, with a lanceolate, oblong or broadly elliptic, acute or obtuse lamina, (2)—3—6—(10 cm. wide, gradually narrowed into the petiole, which is $\frac{1}{4}$ — $\frac{1}{2}$ as long as the lamina. Spathe slightly or $\frac{1}{3}$ shorter than the umbel, persistent, obtuse or almost without a beak. Umbel spherical or more rarely hemispherical, many-flowered, fairly dense, cernuous before flowering; pedicels equal, 2—3 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth whitish-greenish with an inconspicuous nerve, 4—5 mm. long, elliptic, obtuse, the outer ones somewhat narrower and shorter. Filaments almost $1\frac{1}{2}$ times as long as the perianth, adnate at the extreme base to the perianth, entire, gradually narrowed from the extreme base, narrowly triangular, the inner ones $1\frac{1}{2}$ times as broad. Ovary on a short stipe; style exerted from the perianth. Capsule spherico-triquetrous, with broadly obcordate valves; seeds spherical. VI—VII.

In woods, on woodland fringes, in meadows. —EUROPEAN PART: 10 Volga—Kama (E. part); CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. Transcauc.; W. SIBERIA: 26 Ob. (S. part), 27 Upper Tob. (N. part), 29 Alt.; E. SIBERIA: 30 Yenisei (S. part), 32 Ang.—Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 36 Zeya-Bur., 37 Udsu, 38 Ussuri, 39 Sakh. General distr.: Eur., Atl. Eur., W. Medit., Balkans—Asia Minor, India-Himal., Mongolia, Japan-China, N. Amer. Described from the mountains of Central Europe.

Note: Recently (Prokhanov, l. c.) an attempt has been made to distinguish elementary units within *A. Victorialis*, —an attempt which, unfortunately, has taken no account at all of *A. Victorialis* in the old sense.

A. microdictyum (Urals, Siberia, Mongolia), according to Prokhanov, should differ from *A. Victorialis* (Europe, Caucasus) and from *A. latissimum* (Ussuri region, Japan, northern Korea, north China: Chihli) in the less, and irregularly, reticulate envelopes of the bulb, with more slender nerves, in the narrower, often paired leaves, in the often violet-tinted leaf-sheaths, and in the yellowish flowers.

A. latissimum should differ from *A. Victorialis* in the habitat (the former being a woodland plant, the latter an alpine) and broader leaves. The leaves in *A. latissimum* are obovate-oblong, usually 3, the sheaths usually not coloured, the flowers white.

A. ochotense (Kamchatka, Sakhalin) should differ from *A. microdictyum* in the longer rhizome, darker and broader leaves, and flowers often reddish. The differences between this species and *A. Victorialis* and *A. latissimum* are not indicated.

ECONOMIC IMPORTANCE. The *cheremsha* (or *kolba*) is readily used for food in the raw or sour state. It possesses anti-scorbutic properties. In many localities in Siberia very considerable stocks of *cheremsha*, in the salted state, are laid by for the winter.

Section 2. OPHIOSCORODON (*Wallroth*) *Endlicher*, *Gen. Pl.* (1836) 147.¹⁰ —*Ophioscordon* Wallroth, *Sched. Crit.* (1822) 129. — Bulb without a rhizome. Leaf-sheaths subterranean. Spathe deciduous. Perianth-segments with one nerve. Filaments entire. Capsule 3-seeded, seeds globose. [Sp. 2.]

2. A. URSINUM *Linné*, *Sp. Pl.* (1753) 300; *Ledeb. Fl. Ross.* IV (1852) 186; *Boiss. Fl. Or.* V (1882) 275; *Schmalh. Fl.* II (1897) 490. —*A. latifolium* *Gilib. Exerc. Phyt.* (1792) 470. —*Ic.*: *Reichb. Ic. Fl. Germ.* X (1848) f. 1109. —*Exs.*: *HFR* no. 2046 a et b.

Bulb elongate, about 1 cm. thick, with envelopes split into parallel fibres. Scape triquetrous, 15—40 cm. tall, clothed at the base with leaf-sheaths. Leaves 2, somewhat shorter than the scape, with a lanceolate or oblong, acute lamina, \pm gradually narrowed into the petiole, 3—5 cm. wide, equalling, or half as long as, the petiole. Spathe equaling the umbel, acuminate, deciduous. Umbel fasciculate or hemispherical, comparatively few-flowered, dense; pedicels equal, 1.5—2 times as long as the perianth, scabrid or smooth, without bracteoles at the base. Segments of the almost stellate perianth white, with an inconspicuous nerve, 9—12 mm. long, linear-lanceolate, obtuse or subacute. Filaments half as long as the perianth, adnate to it at the base, subulate. Style shorter than the perianth. Capsule spherical, triquetrous, with broadly obcordate valves; seeds almost spherical. V—VI.

In shady woods. —EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga—Don (W. part); CAUCASUS: 20 Ciscauc. 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: Scand., C. Eur., Atl. Eur., W. Medit., Balkans—Asia Min. Described from the island of Gotland.¹¹

ECONOMIC IMPORTANCE. Readily used for food in the raw state.

Section 3. RHIZIRIDIUM *G. Don*, *Mon.* (1827) 55. —Bulbs attached to a rhizome, generally narrow, cylindric-conical or ovoid-conical, sometimes undeveloped, more rarely ovoid or oblong, more often crowded. Scape clothed \pm high up in the aerial part with leaf-sheaths. Perianth-segments with one nerve. Filaments entire or with teeth; teeth short or long, but never exceeding the anther. Seeds angular. [Spp. 3—85.]

¹⁰ [“*Ophioscordon* (Wallr.) (Vved., comb. nov.” in the original, but Endlicher anticipated Vvedensky by almost a hundred years in according Wallroth’s genus *Ophioscordon* sectional rank. —*W. T. S.*]

¹¹ [This statement is misleading as it stands. The name *Allium ursinum* goes back to Roman times, being used by Pliny the younger (1st cent. A. D.), and when Linnaeus gave it modern scientific validity by publication in his *Species Plantarum* he did not describe the plant as a new species from Gotland but referred back to earlier publications by Fuchs, Camerarius, G. Bauhin, Haller, Gmelin and Royen, as well as to his own *Hort. Cliff.*, *Gotlandska Resa*, and *Fl. Suec.*, thus establishing it as a species of northern Europe in general with no definite type-locality: —“*Habitat in Europae septentrionalioris nemorosis.*” —*W. T. S.*]

3. *A. SACCULIFERUM* *Maximovich* in Mém. Acad. Pétersb. Sav. Étrang. IX (1859) 281; Kom. Opred. Rast. Dalnevost. Kraya I (1931) 366. —Exs.: Karo, Pl. Amur. et Zeaëns. no. 181.

Bulbs 1—(2) together, attached to a short vertical rhizome, oblong-ovoid, 0.75—1—(1.5) cm. thick, with black-brown, splitting, indistinctly reticulate-fibrose envelopes, surrounding the base of the scape. Scape (30)—40—60 cm. high, clothed for $\frac{1}{4}$ – $\frac{1}{3}$ with smooth leaf-sheaths. Leaves (2)—3—(4), canaliculate-triquetrous, sometimes fistular at the base, smooth, 2—3—(4) mm. wide, shorter than the scape. Spathe with a beak sometimes $\frac{1}{2}$ as long as the basal part of the spathe, slightly or $\frac{1}{3}$ shorter than the umbel, persistent. Umbel usually spherical, \pm many-flowered, rather dense; pedicels equal, 2—3—(4) times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rose-purple, with a darker nerve, 4.5—5.5 mm. long, elliptic, obtuse, the outer ones cymbiform, somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal at the base, subulate. Style strongly exserted from the perianth. Capsule almost equalling the perianth. VIII—IX.

In damp meadows. —FAR EAST: 36 Zeya-Bur., 38 Ussuri. Gen. distr.: Japan-China. Described from the middle course of the Amur. Type at Leningrad.

4. *A. KOMAROVIANUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 119.

Bulb solitary (?), attached to a short vertical rhizome, ovoid, 1—1.5—(2) cm. thick, with black-brown, almost coriaceous, entire outer envelopes, scarcely embracing the base of the scape. Scape 25—60 cm. high, clothed for $\frac{1}{2}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 4—7, linear, canaliculate, strongly keeled, smooth, 2—5 mm. wide, equalling or slightly shorter than the scape. Spathe with a beak sometimes $\frac{1}{2}$ as long as the basal part of the spathe, approximately equalling the umbel, persistent. Umbel spherical, dense, usually many-flowered; pedicels equal, $1\frac{1}{2}$ —2 times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth dirty-rose-coloured, more deeply coloured on the back, 4—4.5 mm. long, elliptic, obtuse, the outer ones cymbiform, somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal at the base, subulate. Style strongly exserted from the perianth. Capsule slightly exserted from the perianth. IX.

On dry slopes. —FAR EAST: 38 Ussuri. Gen. distr.: Japan-China (Manchuria). Described from Fadeyevka on the Suifun. Type at Leningrad.

5. *A. DROBOVI* *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 125.

Bulbs 1—2 together, attached to an ascending rhizome, narrowly conical, almost cylindric, 0.75—1.5 cm. thick, with coriaceous, brownish,

splitting, \pm reticulate (especially along the margins) envelopes. Scape robust, 50—100 cm. high, clothed for almost $\frac{1}{2}$ or slightly more than $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 5—9, green, broadly linear, 4—15 mm. wide, flat, smooth, considerably shorter than the scape. Spathe shortly acuminate, almost equalling the umbel, persistent. Umbel spherical, many-flowered, dense; pedicels unequal, the outer ones $\frac{1}{3}$ shorter, 2—5 times longer than the perianth, with bracteoles at the base. Segments of the almost spherical perianth greenish-whitish, the outer ones sometimes dirty purple on the back, with a greenish nerve, 4—5 mm. long, broadly oblong, obtuse, the outer ones cymbiform, scarcely shorter than the inner. Filaments almost twice as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate from a somewhat expanded base, equal. Style exserted from the perianth. Capsule slightly longer than the perianth. VI-VII.

On stony and rubbly slopes. —C. ASIA: 49 Tien Shan (Kara Tau, S. W. spurs of the Talas Ala Tau). Endemic. Described from the Kara Tau mountains. Type at Tashkent.

6. *A. OREOSCORDUM* Vvedensky in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 95.

Bulbs 1—(2?) together, attached to an ascending rhizome, narrowly conical about 1 cm. thick, with cinnamomeous or brownish reticulate envelopes. Scape 25—50 cm. high, clothed at the base or for $\frac{1}{3}$ with \pm approximate, smooth leaf-sheaths. Leaves 5—7, linear, 3—6 mm. wide, flat, rigid, scabrid on the margin, considerably shorter than the scape. Spathe shortly acuminate, equalling the umbel, persistent; umbel spherical, many-flowered, dense; pedicels almost equal, the inner ones somewhat longer, ($1\frac{1}{2}$)—2—3 times as long as the inflorescence, with bracteoles at the base. Segments of the almost spherical perianth greenish-whitish, greenish or dirty purple on the back, about 4 mm. long, broadly elliptic, obtuse, the outer ones cymbiform, scarcely shorter than the inner. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the base and adnate to the perianth, the outer ones subulate from a slightly expanded base, the inner almost twice as wide, subulate from an almost quadrate, often bidentate base. Style exserted from the perianth. Capsule equalling the perianth. V—VII.

On stony and rubbly slopes. —ASIA: 49 Tien Shan (Chatkal range Uzankhmat mountains). Endemic. Descr. from Ungar Tyube mountains. Type at Leningrad.

7. *A. FISCHERI* Regel¹² in A. H. P. III, 2 (1875) 161; Kryl. Fl. Zap. Sib. III. (1929) 624.

¹² [For this species a new name appears necessary: —*Allium Eduardi* Stearn, nom. nov.; syn. *A. Fischeri* Regel (1875) non Besser in Roemer et Schultes, Syst. VII (1830) 1081. This new name is proposed in honour of Eduard August von Regel (1815-92), whose "Alliorum adhuc cognitorum Monographia" (1875) has so long been the standard work on the genus *Allium*. —W. T. S.]

Bulbs attached, a few together, to a rhizome, forming a \pm dense tuft, cylindric-conical, 1.5—1 cm. thick, 5—8 cm. long, with rufous-brown reticulate envelopes. Scape 15—30 cm. high, clothed at the base with approximate, smooth leaf-sheaths. Leaves 2—3, semi-cylindric, about 1 mm. wide, canaliculate, smooth, usually shorter than the scape. Spathe with a long beak 3 times longer than the basal part of the spathe, slightly shorter or slightly longer than the umbel, persistent. Umbel usually hemispherical, \pm few-flowered, rather lax; pedicels equal, $(1\frac{1}{2})$ —2—3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth deep-rosy-violet with a darker nerve, about 5 mm. long, acute or obtuse with a short reflexed apiculus, oblong-elliptic or lanceolate, the outer ones somewhat shorter. Filaments somewhat longer than the perianth-segments, connate at the base and adnate to the perianth, the outer ones subulate, the inner bidentate at the base, $1\frac{1}{2}$ times as wide as the outer. Style somewhat exserted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VIII.

On rocks and in stony places.—W. SIBERIA: 29 Altai (rarely). Gen. distr.: Mongolia, Dzung.-Kashg. Descr. from the Altai. Type at Leningrad.

8. *A. CLATHRATUM* Ledebour, Fl. Alt. II (1830) 18; id. Fl. Ross. IV (1852) 178; Kryl. Fl. Zap. Sib. III (1929) 627.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 356¹³.

Bulbs 1—2 together, attached to an ascending rhizome, cylindric-conical, 0.75—1 cm. thick, 5—10 cm. long, with brown coarsely reticulate envelopes. Scape 20—50 cm. high, terete, smooth, ribbed, clothed for $\frac{1}{3}$ with smooth distant leaf-sheaths. Leaves 3, semi-cylindric, canaliculate, (0.5) —1—2 mm. wide, smooth, somewhat shorter than or equalling the scape. Spathe shortly acuminate, $\frac{1}{3}$ shorter than the umbel, persistent. Umbel hemispherical or more often spherical, many-flowered, \pm dense; pedicels equal, $1\frac{1}{2}$ —2—(3) times as long as the perianth, with numerous bracteoles at the base. Segments of the narrowly campanulate perianth rose or pale-rose with a purple nerve, 4—5 mm. long, linear or linear lanceolate, obtuse or subacute, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth, connate at the base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base, more rarely entire; base longer than broad. Style strongly exserted from the perianth. Capsule slightly shorter than the perianth, with broadly elliptic valves. VII.

¹³ The group of species related to *A. lineare* (8-18) is one of the most involved groups of onions. The majority of the species included here are generally appended either to *A. lineare* or to *A. strictum*, or are even united under the one name *A. lineare*. Taxonomy and nomenclature in this group are especially difficult east of the Altai, and cannot be regarded as final.

On steppes and rubbly and stony slopes. —W. SIBERIA: 26 Ob (S. E. part), 29 Altai; E. SIBERIA: 32 Ang. —Sayan (W. part). Gen. distr.: Mongolia. Descr. from R. Charysh. Type at Leningrad.

9. *A. LEUCOCEPHALUM* *Turchaninov* in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 123. —*A. flavo-virens* Regel in A. H. P. X. (1887) 344, t. 8, f. 1.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 0.75—1 cm. thick, 5—8 cm. long, with brown reticulate envelopes. Scape 30—60 cm. high, terete, smooth, slightly ribbed, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2—3, semi-cylindric, canaliculate, fistular, 1—5 mm. wide, gradually narrowed to the apex, smooth, considerably shorter than the scape. Spathe with a beak sometimes exceeding the base of the spathe, somewhat shorter than the umbel, persistent. Umbel spherical, many-flowered, very dense, capitate; pedicels almost equal, slightly shorter or slightly longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white with an inconspicuous greenish or violet nerve, shining, 5—6 mm. long, oblong-elliptic, obtuse, the outer ones almost $\frac{1}{4}$ shorter. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, yellow, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base; base longer than broad; teeth usually equalling the base, often bifurcate. Style strongly exerted from the perianth, stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VIII.

On steppe slopes. —E. SIBERIA: 33 Dauria. Gen. distr.: Mongolia, Kansu. Descr. from R. Dzhida. Type at Leningrad.

10. *A. FLAVIDUM* *Ledebour*, Fl. Alt. II (1830) 7; id. Fl. Ross. IV (1852) 179, excl. syn. Turch.; Kryl. Fl. Zap. Sib. III (1929) 628. —Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) 362.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 0.5—1 cm. thick, 2—4 cm. long, with brown reticulate envelopes. Scape (20)—25—50 cm. high, terete, smooth, ribbed, clothed for almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 2—4, linear, (2)—3—5—(7) mm. wide, with almost parallel margins, obtuse, often somewhat flexuous, flat, scabrid on the margin, considerably shorter than the scape. Spathe scarcely acuminate, somewhat shorter than the umbel, persistent. Umbel spherical, more rarely hemispherical, many-flowered, dense, almost capitate; pedicels almost equal to, or 1.5—(2) times longer than, the perianth, with bracteoles at the base. Segments of the campanulate perianth greenish-pale-yellow, sometimes with a reddish tinge on the back, shining, with an inconspicuous nerve, 5—6 mm. long, oblong-elliptic, obtuse, the outer ones almost $\frac{1}{4}$ shorter than the inner. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, yellow, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate

base; base longer than broad; teeth usually equalling the base, sometimes bifurcate. Style strongly exserted from the perianth, stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VII.

In woodland, or more rarely alpine, meadows, sometimes on stony slopes. —W. SIBERIA: 29 Alt.; C. ASIA: Dzung.—Tarb. (Tarbagatai). Gen. distr.: Mongolian Altai. Descr. from R. Byelaya [White] Uba. Type at Leningrad.

11. *A. MAACKII* (*Maximovich*) *Prokhanov ex Komarov*, *Opred. Rast. Dalnevost. Kraya I* (1931) 366. —*A. lineare* var. *Maackii* Maxim. in *Mém. Acad. Petersb. Sav. Étrang.* IX (1859) 282.

Bulbs 1—2 together, attached to a short rhizome, ovoid-oblong, 1—1.5 cm. thick, 2—5 cm. long, with brown, reticulate, coriaceous, almost entire, sometimes prolonged outer envelopes. Scape (10)—20—50 cm. high, terete, smooth, \pm ribbed, clothed for $\frac{1}{4}$ — $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2—3, narrowly linear, 1—2—(3) mm. wide, somewhat narrowed towards the base, flat, smooth or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or $\frac{1}{3}$ shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, \pm dense; pedicels equal, $1\frac{1}{2}$ —2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a conspicuous purple nerve, 4—5 mm. long, oblong-elliptic or oblong, obtuse or subobtuse, the outer ones slightly shorter. Filaments $1\frac{1}{2}$ —2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide at the base, subulate from a bidentate base; base almost as long as broad. Style strongly exserted from the perianth. Capsule somewhat shorter than the perianth. VI—VII.

In rocky and stony places. —FAR EAST: 38 Ussuri. Endemic (?). Descr. from R. Amur: Sargu. Type at Leningrad.

12. *A. SPLENDENS* *Willdenow ex Roemer et Schultes*, *Syst.* VII, 2 (1830) 1023; *Ledeb. Fl. Ross.* IV (1852) 179, (excl. pl. Kamtsch.). —*A. lineare* auct. fl. Sib. orient. —Exs.: H F R no. 1242, sub *A. lineari*.

Bulbs 1—2 together, attached to a short ascending rhizome, narrowly cylindric-conical, 0.5—0.75 cm. thick, 3—7 cm. long, with brown reticulate envelopes. Scape 25—50 cm. high, slender, terete, smooth, slightly ribbed, clothed for $\frac{1}{3}$ — $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3—4, linear, 1—4 mm. wide, slightly narrowed towards the base, flat, scabrid on the margin, shorter than the scape, spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical, many-flowered, \pm dense; pedicels slender, equal, $1\frac{1}{2}$ —2 times as long as the perianth, with numerous bracts at the base. Segments of the campanulate perianth usually bright rosy-lilac with a strong purple nerve, 3.5—4 mm. long, oblong-elliptic or oblong, obtuse, the outer ones somewhat shorter. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate

from a bi-tri-quadri-dentate base; base usually shorter than broad. Style strongly exserted from the perianth. Capsule somewhat shorter than the perianth-segments. VII—VIII.

In light woodland, bushy places, meadows, stony slopes. —E. SIBERIA: 31 Lena Kolyma (S. part), 32 Ang.—Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 37 Udsu, 38 Ussuri, 39 Sakh. Gen. distr.: Mong., Japan-China. Descr. from Siberia.

13. A. LINEARE *Linné*, Sp. Pl. (1753) 295; Ledeb. Fl. Ross. IV (1852) 178, pro max. parte; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. Sib. III (1929) 625, excl. var. *strictum*. —Ic.: Regel, Fl. Turk.¹⁴ (1876) t. 13, f. 1—5.

Bulbs 1—2 together, attached to an ascending rhizome, cylindrical, 0.5—1 cm. thick, 3—4—(6) cm. long, with brown reticulate envelopes. Scape (20)—30—60 cm. high, terete, smooth, slightly ribbed, clothed for $\frac{1}{3}$ — $\frac{1}{2}$ with distant smooth leaf-sheaths. Leaves 3—4, narrowly linear, 1—3 mm. wide, flat, smooth or hispid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or $\frac{1}{3}$ shorter than the umbel, persistent. Umbel spherical or hemispherical, many-flowered, comparatively lax; pedicels slender, equal, ($1\frac{1}{2}$)—2—3 times as long as the perianth, with numerous bracteoles at the base. Segments of the campanulate perianth rose-coloured with an inconspicuous nerve, 3.5—4—(5) mm. long, oblong-elliptic or oblong, obtuse, often with a short reflexed apiculus, the outer somewhat shorter. Filaments usually $1\frac{1}{2}$ —2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, subulate from a bidentate base; base longer than broad, teeth sometimes forked. Style strongly exserted from the perianth, stigma scarcely thickened. Capsule with broadly elliptic valves, equalling or slightly exceeding the perianth. VI—VII.

On steppes and meadows, more rarely in bare places. —EUROPEAN PART: 10 Volga—Kama (S. E. part), 13 Volga—Don (E. part), 14 Transvolga, 18 Lower Don, 19 Lower Volga; W. SIBERIA: 27 Upper Tob., 28 Irt., 29 Alt. (rarely); C. ASIA: 40 Aral—Casp., 41 Balkhash, 42 Dzung—Tarb. Gen. distr.: N. W. Mongolia. Described from Siberia.

14. A. STRICTUM *Schrader*, Hort. Goett. (1809) 7, t. 1; Ledeb. Fl. Ross. IV (1852) 178, excl. pl. Cauc.; Schmalh. Fl. II (1897) 492. —A. *volhynicum* Besser, Catal. Hort. Crem. Suppl. III (1814) 2. —A. *Schrenki* Regel in A. H. P. III (1875) 172. —A. *lineare* var. *strictum* Krylov, Fl. Zap. Sib. III (1929) 626. —Ic.: Fl. S. E. III (1929) fig. 179. —Exs.: Pl. Finl. exs. no. 572.

Bulbs 1—2 together, attached to an ascending rhizome, almost cylindrical, 0.75—1.5 cm. thick, 6—8—(10) cm. long, with brown reticulate

¹⁴ [See footnote 5, above. —W. T. S.]

envelopes. Scape 40—60 cm. high, terete, smooth, ribbed, clothed for $\frac{1}{3}$ with distant smooth leaf-sheaths. Leaves 3—4, linear, 3—5 mm. wide, flattish, rigid, scabrid on the margin, narrowed towards the apex, shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical or more rarely spherical, \pm many-flowered, dense; pedicels comparatively thick, almost equal, $1\frac{1}{2}$ —2—(3) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured, with a strong purple nerve, 4—5 mm. long, elliptic or oblong-elliptic, obtuse, the outer somewhat shorter. Filaments usually somewhat longer than the perianth, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad at the base, usually shortly bidentate at the base, more rarely with long teeth or entire. Style exserted from the perianth; stigma almost capitate. Capsule somewhat shorter than the perianth. VI—VII.

Principally in bare places and on rocks. —EUROPEAN PART: 7 Dvina—Pechora, 10 Volga—Kama (E. part), 13 Volga—Don. (E. part), 14 Transvolga; W. SIBERIA: 26 Ob (S. part), 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 31 Lena—Kol., 32 Ang—Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 36 Zeya—Bur., 39 Sakh.; C. ASIA: 41 Balkhash, 42 Dzung.—Tarb., 49 Tien Shan (Tur Aigyr). Gen. distr.: C. Eur., Scand., Mongolia. Descr. from Siberia.

15. *BOGDOICOLA Regel* in A. H. P. VI (1880) 530.

Bulbs attached singly to an ascending rhizome, cylindric, 0.75—1 cm. thick, (4)—6—8 cm. long, with brown reticulate envelopes. Scape 20—40 cm. high, terete, smooth, slightly ribbed, clothed for $\frac{1}{3}$, more rarely up to $\frac{1}{2}$ or at the base, with smooth sometimes reddish leaf-sheaths. Leaves 3, linear, 2—4 mm. wide, flat, scabrid on the margin, with almost parallel margins, rather rigid, almost erect, obtuse, distinctly shorter than the scape. Spathe shortly acuminate, equalling, or scarcely shorter than, the umbel, persistent. Umbel spherical, many-flowered, dense, almost capitate; pedicels almost equal, equalling, or twice as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured, darker on the back with a strong purple nerve, 4—5 mm. long, oblong-linear or oblong-lanceolate, obtuse, the outer ones somewhat shorter than the inner. Filaments somewhat shorter or scarcely longer than the perianth-segments, connate at the base and adnate to the perianth, rose-coloured, the outer ones subulate, the inner 3 times as broad at the base, bidentate or entire at the base. Style exserted from the perianth; stigma scarcely thickened. Capsule scarcely shorter than the perianth, with broadly elliptic valves. VII.

In alpine meadows. —C. ASIA: 42 Dzung. —Tarb. Gen. distr.: Dzung. —Kashg. Described from the Bogdo Mats. Type at Leningrad.

Note. Very close to *A. amphibolum*, and requires further study.

16. *A. AMPHIBOLUM Ledebour*, Fl. Alt. II (1830) 5; id. Fl. Ross. VI (1852) 179; Kryl. Fl. Zap. Sib. III (1929) 624. —Ic.: Ledeb. Ic. Pl. Fl. Ross. VI (1833) tab. 357.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 1—1.5 cm. thick, (4)—6—8 cm. long, with brown reticulate envelopes. Scape 10—25 cm. high, terete, smooth, slightly ribbed, clothed at the base or for $\frac{1}{3}$ with smooth, \pm approximate, sometimes reddish sheaths. Leaves 2—4, linear, 2—5 mm. wide, flat, scabrid on the margin, somewhat narrowed towards the base and apex, usually somewhat flexuous, scabrid on the margin, obtuse, somewhat shorter than, or equalling, the scape. Spathe shortly acuminate, approximately equaling the umbel, persistent. Umbel spherical or hemispherical, dense, capitate; pedicels equal, somewhat shorter than or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth rose or rose-purple with a darker nerve, shining, 5—6 mm. long, oblong-lanceolate, or lanceolate, sub-obtuse, the outer somewhat shorter than the inner. Filaments slightly or $1\frac{1}{2}$ times longer than the perianth-segments, connate at the base and adnate to the perianth, deep-rose, the outer ones subulate, the inner 1—2-toothed at the base. Style strongly exserted from the perianth; stigma scarcely thickened. Capsule somewhat shorter than the perianth, with broadly elliptic valves. VI—VII.

On stony and rubbly slopes in the alpine zone. —W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang—Sayan (S. E. part). Gen. distr.: Mongolia. Descr. from R. Charysh and from the neighborhood of Riddersk. Type at Leningrad.

17. A. SZOVITSI *Regel* in A. H. P. III, 2 (1875) 171, quoad pl. Cauc.—*A. strictum* Ledebour, Fl. Ross. IV (1852) 178, quoad pl. Cauc.—*A. strictum* var. *anodon* Boissier, Fl. Or. V (1882) 247. —*A. pseudostrictum* Albov in Tr. Tifl. Bot. Sada [Bull. Tifl. Bot. Gard.] I (1895) 238.

Bulbs 1—2 together, attached to an ascending rhizome, cylindro-conical, 1—1.5 cm. thick, 3—10 cm. long, with brown reticulate envelopes. Scape 15—30 cm. high, terete, smooth, slightly furrowed, clothed for $\frac{1}{4}$ with smooth sometimes reddish leaf-sheaths. Leaves 2—3, linear, 2—4 mm. wide, flat, scabrid on the margin, obtuse, scarcely narrowed towards the base, shorter or somewhat longer than the scape. Spathe shortly acuminate, equally or somewhat shorter than the umbel, persistent. Umbel hemispherical or almost spherical, dense, almost capitate; pedicels equal, almost half as long as or somewhat longer than the perianth, thick, with a few bracteoles at the base. Segments of the campanulate perianth rose-coloured or almost white with a strong purple nerve, (5)—6—7 mm. long, lanceolate or oblong-lanceolate, obtuse or subacute, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide, subulate from a bidentate base or sometimes entire; base distinctly longer than broad. Style strongly exserted from the perianth, stigma almost capitate. Capsule somewhat shorter than the perianth. VII—VIII.

In mountain meadows and on stony slopes. —CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: Arm. —Krud. Descr. from the Karabagh: Kins Mts. Type at Leningrad.

18. *A. BRACHYODON* Boissier, Diagn. Pl. Or. I, 7 (1846) 117. —*A. strictum* var. *brachyodon* [(Boissier) Regel in A. H. P. III, 2 (1875) 116;] Boiss. Fl. Or. V (1882) 247. —Ic.: Fl. Turkm. II (1932) 275.

Bulbs 2—3 together, attached to an ascending rhizome, cylindric, 1—1.5 cm. thick, 5—10 cm. long, with grey-brown, coriaceous, splitting, coarsely reticulate envelopes. Scape 10—20 cm. high, terete, smooth, slightly furrowed, clothed at the base with smooth approximate leaf-sheaths. Leaves 3—4, linear, 2—3 mm. wide, flat, scabrid on the margin, equalling the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or hemispherical, few-flowered, dense; pedicels equal, somewhat shorter than the perianth, with a few bracteoles at the base. Segments of the broadly campanulate perianth whitish, rosy on the back, with a dark purple nerve, about 5 mm. long, obtuse, the outer ones oblong, somewhat shorter than the ovate inner ones. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as wide at the base, subulate from a bidentate base; base longer than broad; teeth often themselves toothed. Style exerted from the perianth, stigma almost capitate. Capsule equalling the perianth, with rounded valves. VII.

In stony places. —C. ASIA: 45 Mountain Turkm. (Chapan Dag). Gen. distr.: Iran. Descr. from Kuh Dayen Mts. Cotype at Leningrad.

19. *A. OREOPRASOIDES* Vvedensky in Trans. Sci. Soc. Turk. II (1925) 29, t. 1.

Bulbs crowded, a few together, attached to an ascending rhizome, cylindro-conical, 0.5—1 cm. thick, with rufous-brown reticulate envelopes. Scape 20—30 cm. high, furrowed, clothed at the base with smooth approximate leaf-sheaths. Leaves 4—6, linear, 2—3 mm. wide, flat, smooth, narrowed towards the apex, somewhat flexuous, more than half as long as the scape. Spathe with a beak sometimes equalling the basal part of the spathe, $\frac{1}{2}$ — $\frac{2}{3}$ as long as the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, 2—3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate-ovoid perianth pale rose with a purple nerve, 4—5 mm. long, almost equal, oblong-elliptic, subacute, the outer ones cymbiform. Filaments one-quarter longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner ones $1\frac{1}{2}$ times as broad. Style strongly exerted from the perianth. Capsule equalling the perianth. V.

On rubbly slopes. —C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from Okuz Bulak. Type at Tashkent.

20 *A. OREODICTYUM* Vvedensky in Bull. Univ. As. Centr. 19 (1934) 119.

Bulbs ovoid-conical, 0.75—1 cm. thick, 3—4 cm. long, attached, a few together, to a short rhizome, with brown reticulate envelopes. Scape 5—15 cm. high, slender, furrowed, smooth, clothed for $\frac{1}{4}$ or at the base with smooth leaf-sheaths. Leaves 2, filiform, 0.5—1 mm. wide, semi-cylindric, canaliculate, smooth, apparently equalling the scape. Spathe with a beak sometimes equalling half the base of the spathe, half as long as the umbel, persistent. Umbel brittle, hemispherical or almost spherical, comparatively few-flowered, lax; pedicels¹⁵ equal, $1\frac{1}{2}$ —2—3 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate, almost spherical perianth rosy, with a strong dirty-green nerve, 2—3.5 mm. long, obtuse or with a short apiculus, the inner ones elliptic or oblong-elliptic, the outer ovate or oblong, slightly concave. Filaments slightly or $1\frac{1}{2}$ times longer than the perianth, connate at the base and adnate to the perianth, subulate from a triangular, sometimes bluntly toothed base, which is twice as broad in the inner ones. Style scarcely exerted from the perianth. Capsule spherical, scarcely shorter than the perianth. VII.

Rubbly slopes. —C. ASIA: 48 Pam.—Al. (Mogian Darya: Sor Sai, Kshtut). Endemic. Descr. from Sor Sai. Type at Leningrad.

21. *A. SCABRISCAPUM* Boissier et Kotschy in Boiss. Diagn. Pl. Or. I, 13 (1853) 31; Boiss. Fl. Or. V (1882) 246.—Exs.: Herb. Fl. As. Med. no. 339.

Bulbs crowded, a few together, attached to a short ascending rhizome, cylindro-conical, about 1 cm. thick, with brownish reticulate envelopes. Scape 25-50 cm. high, erect, furrowed, scabrid, more rarely almost smooth, clothed at the base with smooth or scabrid or almost shaggy leaf-sheaths. Leaves 4-6, linear, 2-4 mm. wide, flat, scabrid or sometimes pilose, distinctly shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel hemispherical or more often spherical, many-flowered, rather lax, brittle; pedicels equal, 3-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate almost hemispherical perianth yellow, brownish in the herbarium, especially on the back, 4-6 mm. long, almost equal, oblong, obtuse. Filaments equalling, or $\frac{2}{3}$ as long as, the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a triangular base, the inner ones twice as broad. Style exerted from the perianth. Capsule somewhat shorter than the perianth. V-VI.

On rubbly slopes in the lower mountain zone.—CAUCASUS: 24 S. Transcauc. (Nakhichevan); C. ASIA: 45 Mountain Turkm., 49 Tien-Shan (Kara-Tau, Tashkent Ala Tau). Gen. Distr.: Iran. Descr. from Mt. Elbrus. Cotype at Leningrad.

Note. The western Tien-Shan plant differs in its more strongly developed pubescence, approaching in this respect *A. trachyscordum*, which also grows in the western Tien-Shan.

¹⁵ [*Sphalm.* "bracteoles" in the original. —Translator's note.]

22. *A. TRACHYSCORDUM* *Vvedensky* in Herb. Fl. As. Med. (1925) no. 65 [in Bull. Univ. Asie Centr. IX (1925)].

Bulbs crowded, a few together, attached to an ascending rhizome, cylindro-conical, with brown reticulate envelopes. Scape 25-30 cm. high, erect, furrowed, very scabrid, almost pilose, clothed at the base or for $\frac{1}{4}$ with shaggy leaf-sheaths. Leaves 3-4, linear, 1.5-3 mm. wide, flat, usually hairy, more rarely only so on the margin, distinctly shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, persistent, externally scabrid. Umbel hemispherical, more rarely spherical, many-flowered, lax; pedicels equal, 2-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate perianth reddish-violet, cinnamomeous in the herbarium, usually 7 mm., more rarely 5-6 mm. long, almost equal, oblong-lanceolate, acute, very rarely obtuse. Filaments somewhat shorter than the perianth, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner somewhat broader. Style somewhat exserted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VI-VII.

On outcrops of particoloured rocks and on stony slopes.—C. ASIA: 49 Tien Shan (Kara Tau, Alexander Range, Chu-Ili Mts.). Endemic. Descr. from Alexander Range: Uch Bulak. Type at Tashkent.

2. *A. GUSARICUM* *Regel* in A.H.P. X (1887) 349, tab. 3, fig. 3.

Bulbs crowded, a few together, attached to a short ascending rhizome, cylindric-conical, about 0.5 cm. thick, with brownish reticulate envelope. Scape 5-15 cm. high, slender, furrowed, smooth, clothed at the base with scabrid or pilose leaf-sheaths. Leaves 3-4, narrowly linear, 0.5-1.5 mm. wide, apparently flat, pilose, distinctly shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate or hemispherical, few-flowered, lax; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth, in the herbarium, violet with a cinnamomeous tinge, 7-8 mm. long, almost equal, linear-lanceolate, attenuate, acute. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate, entire, the outer ones triangular-subulate, the inner twice as broad, narrowly triangular. Style not exserted from the perianth. Capsule $\frac{1}{2}$ as long as the perianth. VI-VII.

On stony slopes.—C. ASIA: 48 Pam.-Al. (Zeravshan valley). Endemic. Described without indication of native country. Type at Leningrad: Zeravshan valley: Guzar-Kshtut.

24. *A. INCONSPICUUM* *Vvedensky* in Not. Syst. Herb. Horti. Bot. Petrop. V (1924) 93.—*A. tataricum* auct. fl. As. Med., p.p.

Bulbs 1-4 together, attached to an oblique rhizome, oblong-ovoid, 0.5-0.75-(1.5) cm. thick, 1-1.5-(3) cm. long; with brown reticulate envelopes. Scape 15-30 cm. high, slender, clothed at the base with smooth or more rarely scabrid leaf-sheaths. Leaves 1-2, narrowly linear, often almost filiform, 0.5-1 mm. wide, canaliculate, smooth or more rarely

scabrid on the margin and nerve, somewhat shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, persistent. Umbel fasciculate, few-flowered, rather lax; pedicels almost equal, half as long as, equal to, or longer than the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth pale dirty-violet, cinnameous-violet on the back, 8-11 mm. long, almost equal, linear-lanceolate or oblong-lanceolate, attenuate, acute. Filaments scarcely more than half as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones triangular-subulate, the inner narrowly subulate, twice as broad as the outer; anthers violet. Style not exerted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. IV-V.

On foothills, principally on outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. (Nura Tau, low mountains along left bank of Zeravshan), 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the station of Ziadin and the Tashkent-Chimkent particoloured [? rock, ? soil] region. Type at Leningrad.

Note. In the Kara Tau mountains examples are sometimes met with which, in flower colour (judging from the herbarium), approach the race of *A. Barszczewskii* that prevails there.

25. *A. DREPANOPHYLLUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 120.

Bulbs 1-3 together, attached to an oblique rhizome, (0.5)-0.75-1.5 cm. thick, (1.5)-3-6 cm. long, with brown reticulate envelopes. Scape 15-45 cm. high, clothed at the base with scabrid or smooth leaf-sheaths. Leaves 4-5, linear, 2.5-10 mm. wide, flat, falcately curved, obtuse, smooth or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, slightly or $\frac{1}{2}$ -($\frac{2}{3}$) shorter than the umbel, persistent. Umbel fasciculate or fasciculate-spherical, comparatively few-flowered, rather lax; pedicels unequal, $1\frac{1}{2}$ -2, in fruit 3 times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth cinnameous-violet, more deeply coloured on the back, 8-10 mm. long, equal, linear-lanceolate, attenuate, acute. Filaments half as long as the perianth-segments, and connate, entire; the outer ones triangular-subulate, the inner twice as broad, triangular; anthers violet or yellow. Style exerted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. V.

In the lower mountain zone, principally on outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. (S. W. part). Endemic. Descr. from the Baisun region: Khodzha Ipak. Type at Leningrad.

Note. *A. drepanophyllum* represents, together with *A. inconspicuum*, a very aberrant form with broad falcate leaves, in this respect approaching *A. xiphopetalum*. Its relation to *A. inconspicuum*, as accepted here, requires further study.

26. *A. XIPHOPETALUM* *Aitchison et Baker* in Trans. Linn. Soc. ser. 2, Bot. III, 1 (1888) 118, t. 48. —*A. tataricum* Boiss. Fl. Or. V (1882) 246, quoad pl. Kotschyanam.

Bulbs 1-3 together, attached to an oblique rhizome, narrowly conical or ovoid-conical, 0.75-1 cm. thick, 3-4 cm. long, with light-brown finely reticulate envelopes. Scape (20)-30-40 cm. high, clothed at the base or for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, linear, 3-5-(10) mm. wide, flat, falcate, obtuse, smooth, or scabrid on the margin, scarcely more than $\frac{1}{2}$ as long as the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel fasciculate or hemispherical, few-flowered, dense; pedicels almost equal, half as long as, equalling, or (in fruit) twice as long as, the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, 9-12 mm. long, attenuate, subacute, the outer ones oblong-lanceolate, somewhat longer than the inner lanceolate ones. Filaments $\frac{2}{3}$ - $\frac{3}{4}$ as long as the perianth-segments, connate and adnate to the perianth half-way, entire, the outer ones triangular-subulate, the inner ones twice as broad, triangular; anthers generally violet. Style not exerted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. IV-V.

On stony slopes.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. (Pistali Tau, Sulyukta). Gen. distr.: Iran. Descr. from the Parapamirus. Cotype at Leningrad.

27. A. BARSZCZEWSKII *Lipsky* in A.H.P. XVIII (1900) 114.—*A. tataricum* auct. fl. As. Med., p. p.—Ic.: Regel, Fl. Turk. (1876) t. 14, f. 1-5.

Bulbs (1)-2—few together, attached to an oblique rhizome, elongate-conical or ovoid-conical, 0.75-1.5 cm. thick, 3-5 cm. long, with brown reticulate envelopes. Scape 20-60 cm. high, clothed for $\frac{1}{3}$ with smooth or (the lower ones) scabrid leaf-sheaths. Leaves 3-5, linear, 1-3 mm. wide, canaliculate, smooth, or scabrid on the margin, shorter than the scape. Spathe shortly acuminate, ($\frac{1}{3}$)- $\frac{1}{2}$ as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, usually many-flowered, mostly dense; pedicels unequal, somewhat shorter than, equal to, or 2-(3) times as long as, the perianth, generally without bracteoles at the base. Segments of the campanulate perianth white, pale-rose, rose or rosy-violet, 7-14 mm. long, equal, more rarely the outer ones $\frac{1}{4}$ shorter, linear-lanceolate, lanceolate or oblong-lanceolate, attenuate, acute. Filaments $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{3}$ - $\frac{1}{2}$ entire, the outer ones triangular-subulate, the inner triangular, 2-3 times as wide as the outer; anthers yellow. Style not exerted from the perianth; capsule $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth, with valves devoid of cartilaginous teeth. V-VIII.

On stony, more rarely on earth slopes, from the lower to the upper mountain zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Karategin: Sary Kuh-i-Kalon pass. Type at Leningrad.

28. A. LUTESCENS *Vvedensky* in Herb. Fl. As. Med. (1935) no. 610.

Bulbs 1-2 together, attached to an oblique rhizome, elongate-conical or ovoid-conical, 0.75-1 cm. thick, 2-5 cm. long, with brown reticulate

envelopes. Scape 20-35 cm. high, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-5, linear, 1-2.5 mm. wide, canaliculate, smooth, approximately equalling the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, \pm many-flowered, dense; pedicels almost equal, somewhat shorter than or $1\frac{1}{2}$ -(2) times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth pale-yellow, 8-12 mm. long, almost equal, linear-lanceolate, very attenuate, acute. Filaments $\frac{1}{2}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{2}$, entire, the outer ones triangular-subulate, the inner ones twice as broad, triangular; anthers yellow. Style not exerted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. V.

On rubbly and stony slopes.—C. ASIA: 49 Tien Shan. Endemic. Descr. from R. Mashat. Type at Tashkent.

Note. Known from a very restricted area in the north-western foothills of the Talas Ala Tau, where it has been gathered by many collectors.

29. *A. LONGIRADIATUM* (*Regel*) *Vvedensky* in *Opred. Rast. Okrest. Tashk.* [Key Pl. Neighb. Tashk.] I (1923) 67. *A. tataricum* var. *longiradiatum* *Regel* in *A. H. P.* III, 2 (1875) 180.— *Ic.*: *Regel*, *Fl. Turk.* (1876) t. 14, f. 6.—*Exs.*: *Herb. Fl. As. Med.* no. 60.

Bulbs 1-2-(4) together, attached to an oblique rhizome, ovoid-conical or elongate-conical, 0.75-1.5 cm. thick, 2-5-(7) cm. long, with brown reticulate envelopes. Scape 25-50 cm. high, clothed for $\frac{1}{3}$ with smooth or (the lower, often) scabrid sheaths. Leaves 4-5, linear, 1-3 mm. wide, canaliculate, fistular, smooth or scabrid, often shorter than the scape. Spathe shortly acuminate, $\frac{1}{8}$ - $\frac{1}{4}$ as long as the umbel, persistent. Umbel spherical, more rarely hemispherical, many-flowered, lax; pedicels almost equal, 4-6 times as long as the perianth, with bracteoles at the base, the outer ones usually ascending. Segments of the narrowly campanulate perianth purple-violet, 7-9 mm. long, almost equal, linear-lanceolate, attenuate, acute. Filaments $\frac{1}{2}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{2}$, entire, the outer ones triangular-subulate, the inner 3 times as broad, triangular. Style not exerted from the perianth; ovary without a corona [cf. no. 33, *A. stephanophorum*]. Capsule half as long as the perianth. V.

On foothills, principally on outcrops of particoloured rocks.—C. ASIA: 49 Tien Shan (Tashkent Ala Tau). Endemic. Descr. from neighbourhood of Tashkent. Type at Tashkent.

30. *A. DOLICHOMISCHUM* *Vvedensky* in *Herb. Fl. As. Med.* (1935) no. 606.

Bulbs 1-2-(3) together, attached to an oblique rhizome, oblong-ovoid or conic-ovoid, (0.5)-0.75-1 cm. thick, 1.5-3 cm. long, with brown finely reticulate envelopes. Scape (10)-20-90 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 4-5, linear, (1)-3-4 mm. wide, flat, twisted, falcately curved, smooth, shorter than the scape. Spathe

shortly acuminate, $\frac{1}{4}$ - $\frac{1}{3}$ -($\frac{1}{2}$) as long as the umbel [*sphalm* "perianth"], persistent. Umbel hemispherical, generally many-flowered, lax; pedicels almost equal, (2)-3-4 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth generally pale-violet with a dark-violet nerve, more rarely dark-violet, 5-7 mm. long, equal, linear-lanceolate or lanceolate, attenuate, acute, the outer ones somewhat broader. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{3}$, entire, the outer ones triangular-subulate, the inner twice as broad, narrowly triangular; anthers yellow or violet. Style not exerted from the perianth; ovary without a corona. Capsule $\frac{2}{3}$ as long as the perianth. V-VI. (Tab. XI. fig. 1a).

In the intermediate mountain zone, on outcrops of particoloured rocks (always?).—C. ASIA: 48 Pam.—Al. (W. part of Hissar range, Mt. Chulbair). Endemic. Descr. from Mt. Chulbair: Sina. Type at Tashkent.

31. *A. DOLICHOSTYLUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 120.

Bulbs 1-3 together, attached to a short rhizome, elongate-conical or ovoid-conical, 0.5-1.5 cm. thick, 1.5-4 cm. long, with brown reticulate envelopes. Scape 30-70 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth, more rarely scabrid leaf-sheaths. Leaves 4-5, linear, 1.5-4 cm. wide, canaliculate, generally scabrid on the margin, shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel usually hemispherical, more rarely fasciculate-hemispherical or almost spherical, many-flowered, dense; pedicels almost equalling, equalling, or 1.5(2) times as long as, the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured with a darker nerve, (5)-7-9 mm. long, equal, attenuate, acute, the inner ones lanceolate or linear-lanceolate, the outer oblong-lanceolate or lanceolate. Filaments equalling, or scarcely longer than, the perianth-segments, connate and adnate to the perianth for $\frac{1}{6}$, entire, the outer ones triangular-subulate, the inner narrowly triangular, $1\frac{1}{2}$ times as broad as the outer; anthers usually yellow. Style exerted from the perianth. Capsule $\frac{1}{2}$ as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. VI-VII.

Stony and rubbly slopes of the intermediate mountain zone.—C. ASIA: 48 Pam.—Al. (Alai range), 49 Tien Shan. Endemic. Descr. from Sary Chilek. Type at Leningrad.

NOTE. In the Chatkal range there have repeatedly been collected small-flowered (5-6 mm.) examples, requiring further study.

32. *A. IDERIENSE* *Fischer ex Bunge* in Goebel, Reise . . . II (1838) 311.—*A. tataricum* Ledebour, Fl. Ross. IV (1852) 185; Boiss. Fl. Or. V (1882) 246, quoad pl. Lehmannianam.—*A. diaphanum* Janka, Linnaea XXX (1860) 605.—*A. Beckerianum* Regel, Ind. Sem. Horti Petrop. (1860) 30.—Ic.: Fl. Yugo-Vostoka [South-East] III (1929) fig. 180.

Bulbs 1-4 together, attached to an oblique rhizome, ovoid-conical, 0.75-1.5 cm. thick, 1-3-(4) cm. long, with brown reticulate envelopes. Scape 20-40 cm. high, clothed at the base or for $\frac{1}{4}$ with smooth leaf-sheaths. Leaves 3-5, linear, 1-3 mm. wide, canaliculate, generally scabrid on the margin, shorter than the scape. Spathe with a short beak, half as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, more rarely hemispherical, comparatively few-flowered, dense; pedicels almost equal, half as long as, equal to, or (in fruit) $1\frac{1}{2}$ times as long as, the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, 7-10 mm. long, equal, attenuate, acute, the outer ones oblong-lanceolate, the inner lanceolate. Filaments equalling the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, entire, the outer ones triangular-subulate, the inner $1\frac{1}{2}$ times as broad, narrowly triangular; anthers violet. Style exserted from the perianth. Capsule half as long as the perianth, with almost circular emarginate valves devoid of cartilaginous teeth. V-VI.

Salt-marshy steppes.—EUROPEAN PART: 19 Lower Volga; W. SIBERIA: 27 Upper Tob. (S. E. part); C. ASIA: 40 Aral-Casp., 41 Balkhash. Endemic. Descr. from Lake Inder. Type at Leningrad.

33. *A. STEPHANOPHORUM* *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 94.—*A. tataricum* auct. fl. As. Med., p. p.

Bulbs 1-4 together, attached to an oblique or ascending rhizome, elongate-conical or oblong-ovoid, 0.5-1.5 cm. thick, 2-5 cm. long, with rufous-brown reticulate envelopes. Scape 15-50 cm. high, clothed at the base with smooth or (especially the lower) scabrid leaf-sheaths. Leaves 3-5, narrowly linear, 0.5-2.5 mm. wide, slightly canaliculate, often recurved, generally scabrid on the margin. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate or almost hemispherical, comparatively few-flowered, \pm dense; pedicels unequal, half as long as or slightly longer than (in fruit twice as long as) the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth dirty-violet or rosy-violet (?) with a darker nerve, attenuate, subacute or subobtuse, the outer ones (6)—8-12 mm. long, linear-lanceolate or lanceolate, $\frac{1}{4}$ longer than the inner lanceolate or oblong-lanceolate ones. Filaments half as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{2}$, entire, the outer ones triangular-subulate, the inner almost 3 times as broad, triangular; anthers yellow. Style not exserted from the perianth; ovary with cartilaginous teeth at the apex, forming a corona surrounding the base of the style. Capsule half as long as the perianth. V.

On clayey and rubbly slopes in the lower mountain zone.—C. ASIA: 48 Pam.—Al. (Turkestan range, Nura Tau, low mountain region of Baisun, Shurab), 49 Tien Shan (Mogol Tau). Endemic. Descr. from Turkestan range. Type at Leningrad.

Note. In the Kyzyl Kum (Ak Tau, Changhildy), plants have been

collected, very close to *A. stephanophorum*, but differing in their equal perianth-segments; they require further study.

34. *A. TENUICAULE* *Regel* in *A. H. P. X* (1887) 348, t. 4, f. 4.—*A. tataricum* auct. fl. *As. Med.*, p. p.

Bulbs 2-6 together, attached to a rhizome, ovoid-conical, 0.5-0.75 cm. thick, 1-2 cm. long, with brown reticulate envelopes. Scape 10-20-(30) cm. high, slender, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth or scabrid leaf-sheaths. Leaves 2-3, almost filiform, convolute, scabrid on the margin. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel fasciculate or almost hemispherical, generally few-flowered, dense; pedicels almost equal, half as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth deep-rose, 7-8 mm. long, almost equal, acute, the outer ones oblong, $1\frac{1}{2}$ times as broad as the inner lanceolate ones; Filaments $\frac{2}{3}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{2}$, entire, the outer ones triangular-subulate, the inner twice as broad, triangular; anthers yellow. Style not exerted from the perianth; ovary at the apex with cartilaginous teeth, forming a corona surrounding the base of the style. Capsule $\frac{2}{3}$ as long as the perianth. VI-VII.

Rubbly and stony slopes in the alpine zone.—C. ASIA: 48 Pam.Al. (Zeravshan valley, Chulbair and Kuh-i-Tang mts.). Endemic. Descr. from Zeravshan valley. Type at Leningrad.

35. *A. OREOPRASUM* *Schrenk* in *Bull. Scient. Acad. Pétersb. X* (1842) 354; *Ledeb. Fl. Ross. IV* (1852) 185.—*Id.*; *Regel, Fl. Turk.* (1876) t. 14, f. 7-9.

Bulbs crowded, a few together, attached to a horizontal rhizome, cylindro-conical, 1-1.5 cm. thick, with rufous-brown reticulate envelopes. Scape 20-40 cm. high, slightly ribbed, almost ancipitous above. Leaves 3-5, narrowly linear, 1-4 mm. wide, \pm canaliculate, scabrid on the margin or smooth, congregated at the base of the stem, somewhat shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, \pm few-flowered; pedicels equal, $1\frac{1}{2}$ -2-(3) times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rosy with a strong dirty-purple nerve, 5-7 mm. long, almost equal, broadly elliptic, with acute reflexed apiculi. Filaments $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{3}$, entire, subulate from a triangular base, the inner ones twice as broad, almost broadly triangular. Style not exerted from the perianth. Capsule somewhat shorter than the perianth. V-VII.

On rocks and stony slopes. —C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Alai range, Pamir), 49 Tien Shan (C. Tien Shan, Alexander range, Talas Ala Tau). Gen. distr.: Dzung.-Kashg., Tibet. Descr. from Kul Asu. Type at Leningrad.

NOTE. The localities Kara Tau (*Mayev*) and Guberlin Mts. (*Regel*) are very doubtful.

36. *A. ODORUM* Linné¹⁶ Mant. (1767) 62; Ledeb. Fl. Ross. IV (1852) 185; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 127; Krylov, Fl. Zap. Sib. III (1929) 630; Kom. Oprod. Rast. Delnevost. Kraya I (1931) 365.—*A. tataricum* Linné fil. Suppl. (1781) 196.—Ic.: Redouté, Lil. II (1804) t. 98.—Exs.: H F R, no. 1241.

Bulbs 1-3 together, rarely more, attached to a horizontal rhizome, narrowly cylindric-conical, scarcely distinguishable, with rufous-brown reticulate envelopes. Scape (15)-30-50 cm. high, slightly ribbed. Leaves 2-3, narrowly linear, (1.5)-2-4 mm. wide, congregated at the base of the stem, somewhat shorter than the stem. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ ¹⁷ as long as the umbel, persistent. Umbel fasciculate or fasciculate-hemispherical, \pm many-flowered, dense; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the almost stellate perianth white with a greenish nerve, 6-9 mm. long, almost equal, lanceolate or elliptic, obtuse or subacute. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{4}$, entire, subulate from a somewhat expanded base, almost equal. Style not exerted from the perianth. Capsule about 5 mm. long. VII-VIII.

In meadows and salt-marshy places, and on slopes; rarely as a weed. Cultivated in the Far Eastern Region.—W. SIBERIA: 28 Irt. (E. part), 29 Alt.; E. SIBERIA: 31 Lena-Kolyma, 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA (introduced): 48 Pam.-Al. (Roshan), 49 Tien Shan (Alexander range). Gen. distr.: India-Himal., Japan-China, Tibet. Descr. from C. Europe.

NOTE. Prokhanov (Bull. Appl. Bot. XXIV, 2 (1930) 175) segregates the cultivated plant as a separate species under the name *A. Chinense* Don, distinguishing it by its flat keeled leaves and white flowers. I have observed precisely the same characteristics (judging from the herbarium) in the wild *A. odorum*.

¹⁶["*A. odorum*" of authors covers at least two distinct species:—

1) *A. RAMOSUM* Linné, Sp. Pl. I (1753) 296. —*A. odorum* Linné, Mantissa (1767) 62. —*A. tataricum* Linné fil., Suppl. Pl. (1781) 196. —Illust.: —Redouté, Lilic. II (1804) t. 98; Bot. Mag. XXVIII (1808) t. 1142.

Leaves slightly fistulose. Perianth somewhat campanulate; segments white with a purplish nerve, 6-10 mm. long, lanceolate—oblong. Filaments half as long as the perianth-segments, reddish. Capsule with valves broadest below the middle, clasped by the withered perianth-segments. VI-VII. W. & E. Siberia.

2) *A. TUBEROSUM* Rottler ex Sprengel, Syst. II (1825) 38. —*A. tuberosum* Roxburgh, Hort. Beng. (1814) 24, nomen nudum; Roxburgh, Fl. Indica, 2nd ed. II (1832) 141. —*A. uliginosum* G. Don, Mon. Allium (1827) 60. —*A. Roxburghii* Kunth, Enum. Pl. IV (1843) 454. —"*A. chinense*" Prokhanov in Bull. Appl. Bot. Leningrad, XXIV, 2 (1931) 164, 176, 181, non G. Don. —Illust.: —Inuma, Somoku Dzus. 3rd ed. VI (1910) t. 42; Bull. App. Bot. 1. c.

Leaves not fistulose. Perianth stellate; segments white with a faint brownish or greenish nerve, 4-7 mm. long, narrowly ovate. Filaments four-fifths the length of the perianth segments, white. Capsule with valves broadest above the middle, the withered perianth-segments reflexed from it. VIII-X. Far East; much cultivated as a salad plant. —W. T. S.]

¹⁷ [$\frac{1}{2}$ —2 times shorter" in the original, presumably sphalm. for " $\frac{1}{2}$ —2 times shorter", i. e. " $\frac{1}{2}$ — $\frac{2}{3}$ as long." —Translator's note.]

37. *A. ANGULOSUM* *Linné*, *Sp. Pl.* (1753) 299; *Ledeb. Fl. Ross.* IV (1852) 180; *Kryl. Fl. Zap. Sib.* III (1929) 619.—*A. acutangulum* *Schrader*, *Cat. Sem. Hort. Goett.* (1808); *Schmalh. Fl.* II (1897) 494.—*A. laxum* *G. Don*, *Mon.* (1827) 63.— *Ic.*: *Syreishch. Ill. Fl. Mosc. Gov.* I (1906) 236.—*Exs.*: *Kerner, Fl. exsicc. Austro-Hung.* no. 3481.

Bulbs 1-2-(3) together, attached to a horizontal or ascending rhizome, narrowly conical, 0.5-0.75 cm. thick, with greyish, membranous, almost entire envelopes. Scape 25-50 cm. high, angular, slender. Leaves 5-6, congregated at the base of the scape, \pm carinate, narrowly linear, 2-4 mm. wide, obtuse, smooth, erect, more than half as long as the scape. Spathe shortly acuminate, half as long as the umbel, persistent. Umbel fasciculate-hemispherical or more often hemispherical, many-flowered, \pm dense; pedicels equal, 2-3 times as long as the perianth, with a few bracteoles at the base. Segments of the broadly campanulate perianth rosy-violet, with an inconspicuous nerve, 6-(7) mm. long, acute, oblong, almost equal. Filaments slightly or $\frac{1}{4}$ shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from a somewhat expanded base, the inner ones somewhat broader. Style not exerted from the perianth. Capsule scarcely more than $\frac{2}{3}$ as long as the perianth. VI-VIII.

In meadows.—EUROPEAN PART: 6 Karelian Lapl., 7 Dvina-Pechora, 8, Ladoga—Ilmen, 9 Upper Volga, 10 Volga—Kama, 11 Upper Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 18 Lower Don, 19 Lower Volga; W. SIBERIA: 26 Ob, 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part). *Gen. distr.*: C. Eur. *Descr.* from Siberia.

38. *A. ALBIDUM* *Fischer ex Besser*, *Enum. Pl. Volhyn.* (1822) 55; *Ledeb. Fl. Ross.* IV (1852) 181, quoad pl. *Cauc.*; *Schmalh. Fl.* II (1897) 494.—*A. angulosum* var. *caucasicum* *Regel* in *A. H. P.* III, 2 (1875) 145.— *Ic.*: *Reichb. Ic. Pl. Crit.* (1827) f. 592.

Bulbs 2-4 together, attached to a horizontal rhizome, conical, 0.75-1 cm. thick, with greyish, membranous, \pm entire envelopes. Scape 20-30 cm. high, \pm angular, ribbed. Leaves 6, narrowly linear, 1-2-(4) mm. wide, flattish, canaliculate, apparently somewhat fleshy, obtuse, generally smooth, approximately half as long as the scape. Spathe shortly acuminate, $\frac{2}{3}$ as long as the umbel, persistent. Umbel hemispherical or almost spherical, many-flowered, dense; pedicels equal, slightly or usually $1\frac{1}{2}$ -2 times longer than the perianth, without bracteoles. Segments of the hemispherical almost stellate perianth white, sometimes with a reddish tinge, with an inconspicuous nerve, 4-5 mm. long, obtuse, oblong or oblong-elliptic, entire, the outer ones cymbiform, $\frac{1}{4}$ shorter than the inner. Filaments equalling or scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire or sometimes the inner ones bidentate, the outer triangular-subulate, the inner narrowly triangular, $1\frac{1}{2}$ times as broad as the outer. Style ex-

serted from the perianth. Capsule somewhat shorter than the perianth. VII.

In rocky places.—EUROPEAN PART: 17 Crimea; CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. & 24 S. Transcauc. Gen. distr.: Arm.-Kurd. Descr. from Caucasus.

39. *A. FLAVESCENS* Besser Enum. Pl. Volhyn. (1822) 56; Schmalh. Fl. II (1897) 494.—*A. albidum* Ledebour Fl. Ross. IV (1852) 181, p.p; Krylov, Fl. Zap. Sib. III (1929) 621.—Exs.: H F R no. 1496, sub *A. albidum*.

Bulbs crowded, a few together, attached to a horizontal rhizome, conical, 0.5-0.75 cm. thick, with blackish, almost coriaceous, \pm entire envelopes. Scape 10-30 cm. high, slender, erect, often flexuous, slightly ribbed. Leaves 6-8, filiform, semicylindric, canaliculate, 0.5-0.75 mm. wide, scabrid on the margin, slightly shorter than or half as long as the scape. Spathe half as long as the umbel, shortly acuminate, persistent, umbel fasciculate-hemispherical or hemispherical, many-flowered, dense; pedicels equal, 2-3-(4) times as long as the perianth, without bracteoles at the base. Segments of the hemispherical perianth yellowish with an inconspicuous nerve, 3-4 mm. long, oblong-lanceolate or oblong, almost entire, the stiff¹⁸ outer ones slightly or $\frac{1}{4}$ shorter than the inner, cymbiform. Filaments equalling or somewhat exceeding the perianth segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones almost $1\frac{1}{2}$ times as broad. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII. (Tab. X, fig. 1 a).

On steppes and slopes.—EUROPEAN PART: 10 Volga-Kama (S. part), 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 18 Lower Don; W. SIBERIA: 27 Upper Tob., 28 Irt. Endemic (?). Descr. from S. Russia.

40. *A. STELLERIANUM* Willdenow, Sp. Pl. II (1799) 82; Ledeb. Fl. Ross. IV (1852) 181, quoad var. *a*.

Bulbs crowded, a few together, and attached to a horizontal rhizome, narrowly conical, 0.5-1 cm. thick, with brownish or blackish, membranous or almost coriaceous, \pm entire envelopes. Scape 10-30 cm. high, slender, erect, slightly ribbed. Leaves 4-6, congregated at the base of the scape, semi-cylindric, canaliculate, 0.75-1.5 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe $\frac{2}{3}$ as long as the umbel, shortly acuminate, persistent. Umbel spherical, more rarely hemispherical, \pm few-flowered, dense, often almost capitate; pedicels equal, slightly or $1\frac{1}{2}$ -(2) times longer than the perianth, without bracteoles at the base. Segments of the hemispherical perianth yellow, sometimes with a rosy tinge, with an inconspicuous nerve, (4)-5 mm. long, broadly elliptic or ovate, obtuse, entire, the outer ones cymbiform, somewhat shorter than

¹⁸ [There is probably a printer's error here; the passage should almost certainly read: "segments . . . oblong, almost entire, *obtuse*, the outer ones slightly or $\frac{1}{4}$ shorter . . ." —*Translator's note.*]

the inner. Filaments slightly or $1\frac{1}{2}$ times longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner almost $1\frac{1}{2}$ times as broad. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On slopes.—W. SIBERIA: 29 Alt. (?); E. SIBERIA: 32 Ang.-Sayan. Gen. distr.: Mongolia. Descr. from the Yenisei.

41. *A. PROSTRATUM* *Treviranus*, Ind. Sem. Hort. Wratislaw. (1821); id. All. (1822) 16; Ledeb. Fl. Ross. IV (1852) 182; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 125.—Ic.: Trev. in Acta Acad. Leop.-Carol. XII, 1 (1826) t. 11.

Bulbs 2 (?) together, attached to a horizontal rhizome, cylindric, 0.5-0.75 cm. thick, with brownish almost coriaceous, \pm entire envelopes. Scape slender, weak, ascending, slightly ribbed, 10-25 cm. high. Leaves 5-8, congregated at the base of the scape, semicylindric, canaliculate, 0.75-1.5 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, shortly acuminate, persistent. Umbel hemispherical or almost spherical, few-flowered, \pm lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the almost spherical perianth rosy-violet with an inconspicuous nerve, about 5 mm. long, oblong or more rarely oblong-ovate, obtuse, the inner ones \pm crenate, somewhat longer than the cymbiform outer ones. Filaments equalling or more rarely scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones $1\frac{1}{2}$ times as broad. Style exserted from the perianth. Capsule equalling the perianth. VII.

In stony places.—E. SIBERIA: 31 Lena-Kolyma, 32 Ang.-Sayan (E. part), 33 Dauria. Gen. distr.: Mongolia. Descr. from Pribaikal Siberia.

NOTE. The plant from the Lena-Kolyma region deserves further study—it has often strongly exserted stamens; the flowers, apparently (to judge from the herbarium), sometimes have a yellowish tinge.

42. *A. RUBENS* *Schrader ex Willdenow*, Enum. Pl. Hort. Berol. I (1809) 360.—*A. Stellerianum* Ledebour Fl. Ross. IV (1852) 181, quoad var. *b*; Kryl. Fl. Zap. Sib. III (1929) 620.—Ic.; Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 384.

Bulbs crowded a few together, attached to a horizontal rhizome, narrowly conical, 0.5-1 mm.¹⁹ thick, with brownish, almost coriaceous, \pm entire envelopes. Scape 10-25 cm. high, slender, erect, slightly ribbed. Leaves 5-6, congregated at the base of the scape, semicylindric, canaliculate, 1-1.5-(2) mm. wide, \pm scabrid on the margin, approximately equalling the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel hemispherical or spherical, \pm few-flowered, lax; pedicels equal, 2-(3) times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate almost hemis-

¹⁹ [Presumably *sphalm.* for "cm." —Translator's note.]

spherical perianth rosy-violet with an inconspicuous nerve, (4)-5 mm. long, broadly elliptic or elliptic, obtuse, almost entire, the outer ones somewhat shorter, cymbiform. Filaments equalling or scarcely exceeding the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style not exerted from the perianth. Capsule somewhat shorter than the perianth. VI-VIII.

On rocks and stony slopes.—EUROPEAN PART: 10 Volga-Kama (S. Ural); W. SIBERIA: 26 Ob (S. E. part), 27 Upper ob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung.-Tarb. Gen. distr.: Mongolia. Descr. without indication of native country.

43. *A. TYTTHOCEPHALUM* Roemer et Schultes, Syst. VII, 2 (1830) 1133.—*A. senescens* var. *brevipedicellatum* Regel in A.H.P. III, 2 (1875) 140; Kryl. Fl. Zap. Sib. III (1929) 618.²⁰

Bulbs 1-2 together, attached to a horizontal or ascending rhizome, narrowly conical, almost cylindric, 0.5-0.75 cm. thick, with blackish, membranous, \pm entire envelopes. Scape 15-25 cm. high, ribbed, ancipitous in the upper half. Leaves 2-4, congregated at the base of the scape, apparently semicylindric, canaliculate, 1-2 mm. wide, scabrid on the margin, somewhat shorter than the scape. Spathe shortly acuminate, 2/3 as long as the umbel, persistent. Umbel hemispherical, few-flowered, dense; pedicels equal, slightly shorter or slightly longer than the perianth, without bracteoles. Segments of the broadly campanulate perianth purple with an inconspicuous nerve, 5-6 mm. long, ovate or broadly elliptic, obtuse, the outer ones cymbiform, 1/4 shorter than the inner. Filaments purple, somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style exerted from the perianth. Capsule 2/3 as long as the perianth. VIII. (Tab. X, fig. 2 a).

Rubbly slopes in the alpine region.—W. SIBERIA: 29 Alt. (Lake Balyktykol, R. Saaskandy); E. SIBERIA: 32 Ang.-Sayan (Sayany (?), R. Khatigol). Endemic. Descr. from Siberia.

44. *A. SENESCENS* Linné, Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 180; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 124; Kryl. Fl. Zap. Sib. III (1929) 617; Kom. Opred. Rast. Dalnevost. Kraya, I (1931) 365.—*A. montanum* Schmidt, Fl. Boem. VI (1794) 28.—*A. baicalense* Willdenow, Enum. Hort. Berol. I (1809) 360.—*A. spirale* Willdenow, ibid. Suppl. (1813) 17.—*A. glaucum* Schrader, Cat. Hort. Goett. (1814).—*A. Andersonii* G. Don, Mon. (1827) 59.—*A. spurium* G. Don, l.c.—*A. fallax* Roemer et Schultes, Syst. VII, 2 (1830) 1072; Schmalh. Fl. II (1897) 494.—*A. angulosum* var. *minus* Ledebour Fl.

²⁰ [To the synonymy of *A. tyttocephalum* must be added: —*A. Salesovi* Regel in A. H. P. III. 2 (1875) 140, in obs. sub *A. senescente brevipedicellato*; Simpson in Journ. Linn. Soc. Bot. XLI (1913) 446, pro sp. M. P. Price's material collected on Kizil Taiga, Lower Kemchik river, N. W. Mongolia, on which Simpson's description is based, agrees with Vvedensky's description. The umbel is about 1.5 cm. across, with the flowers almost sessile. The species thus occurs outside the Soviet Union in adjacent Mongolia. —W. T. S.]

Ross. IV (1852) 180.—Ic.: Gmelin, Fl. Sib. I (1747) t. 11, f.2.—Exs.: H F R no. 1342; Karo, Pl. Amur. et Zeaens. no. 179.

Bulbs (1)-2-3 together, attached to a horizontal rhizome, conical, 1-1.5-(2) cm. thick, with blackish, membranous, \pm entire envelopes. Scape (20)-30-60 cm. high, ancipitous or even narrowly winged in the upper part. Leaves 5-8, congregated at the base of the scape, flat, linear, obtuse, \pm glaucous, the outer ones (2)-3-6-(10) mm. wide, smooth, erect or falcate or twisted in a sloping spiral, half as long as the scape or slightly longer than it. Spathe shortly acuminate, ($\frac{1}{3}$)- $\frac{1}{2}$ as long as the umbel, persistent. Umbel hemispherical or more rarely spherical, dense, many-flowered; pedicels equal, 2-3-(4) times longer than the perianth with a few bracteoles at the base or without them. Segments of the hemispherical perianth rose or deep-rose or rosy-violet with an inconspicuous nerve, (4)-5-(6) mm. long, obtuse, oblong-lanceolate to ovate, the inner ones slightly or $\frac{1}{4}$ longer than the outer cymbiform ones. Filaments connate at the extreme base and adnate to the perianth, slightly or $1\frac{1}{2}$ times longer than the perianth, entire, subulate, the inner ones $2\frac{1}{2}$ times as broad. Style exserted from the perianth. Capsule equalling the perianth with obcordate valves. V-VII.

In stony and sandy places, and in meadows.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don (E. part) (?); CAUCASUS (??); W. SIBERIA: 29 Alt.; E. SIBERIA: 31 Lena-Kolyma (S. part), 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA: 42 Dzung-Tarb. (Tarbagatai). Gen. distr.: W. Eur., Mongolia, Manchuria. Descr. from Siberia and Sicily.

NOTE. It falls into four races: the European, known as *A. montanum* (= *A. fallax*) with narrow, (2)-3-(4) mm., erect leaves, with an ancipitous (not winged) scape, and usually with oblong-lanceolate, slightly attenuate inner perianth-segments; the Altai-Sayan, more stocky, with short leaves, usually half as long as the scape, and generally ovate rosy-violet perianth-segments; the Transbaikal, which is the typical one (*A. senescens* s.s. = *A. baicalense*), more robust, with broad, 5-10 mm. wide, falcately curved, short leaves, often with scapes narrowly winged upwards, usually with oblong-lanceolate perianth-segments; and the Far Eastern, to which apparently the names *A. spirale* and *A. glaucum* are referable, with long leaves, approximately equalling the scape and coiled into a sloping spiral, with scape usually narrowly winged above and with ovate perianth-segments.

The indistinct morphological outlines of these races, and especially the presence of a long and involved synonymy (due to brief descriptions which, in the majority of cases, lack any indication of the exact provenance of the species described), make it impossible for me to treat them as independent units.

45. *A. NUTANS* Linné, Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 180; Kryl. Fl. Zap. Sib. III (1929) 616.—Ic.: Bot. Mag. XXVIII (1808) t. 1143.

Bulbs 1-2 together attached to a horizontal or somewhat ascending, thick rhizome, conical, 1.5-2 cm. thick, with blackish, membranous, \pm entire envelopes. Scapes (20)-30-60 cm. high, thick, with 2 usually winged ribs in the upper part. Leaves 6-8, congregated at the base of the scape, flat, glaucous, obtuse, \pm falcate, smooth, the outer ones (5)-8-15 mm. wide, half as long as the scape. Spathe shortly acuminate, $\frac{2}{3}$ as long as the umbel, persistent. Umbel spherical, more rarely almost spherical,²¹ many-flowered, dense, almost capitate, cernuous before flowering; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the hemispherical perianth rose or rosy-violet with an inconspicuous nerve, (4)-5-(6) mm. long, obtuse, oblong-ovate, the inner ones somewhat longer than the cymbiform outer ones. Filaments connate at the extreme base and adnate to the perianth, $1\frac{1}{2}$ times or almost twice as long as the perianth-segments, subulate, the inner ones generally bidentate at the base, twice as broad as the outer. Style exserted from the perianth. Capsule equalling the perianth. VI-VII.

On steppes, meadows and stony slopes.—W. SIBERIA: 26 Ob (S. E. part), 27 Upper Tob., 28 Irt., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung—Tarb. (Saur.). Endemic. Described from Siberia.

46. *A. PUMILUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 121.

Bulbs 1-3 together, attached to a horizontal rhizome, mostly conical, about 0.5 cm. thick, 2-3 cm. long, with greyish, coarsely reticulate, fibrous envelopes. Scape about 10 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 1-2 mm. wide, flat, or slightly canaliculate at the base, \pm falcately recurved, smooth, shorter than the scape. Spathe acuminate, equalling the umbel, persistent. Umbel few-flowered, capitate; pedicels half as long as, more rarely slightly shorter than, the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured, about 4 mm. long, oblong-elliptic, obtuse, the outer ones somewhat shorter. Filaments approximately equalling the perianth-segments, connate at the base and adnate to the perianth, entire, triangular-subulate, almost equal. Style not exserted from the perianth. VII.

Dry slopes.—W. SIBERIA: 29 Alt. (Collected once by B. K. Shishkin on the Ukok plateau in 1931). Type at Leningrad.

47. *A. POLYRRHIZUM* *Turchaninov ex Regel* in A. H. P. III, 2 (1875) 162.

Roots numerous, almost cord-like. Bulbs crowded, a few together, attached to a horizontal rhizome, forming together with the sterile ones a dense tuft, almost cylindric, c. 0.5 cm. thick, with blackish-brown envelopes split into almost reticulate fibres. Scape 10-20 cm. high, slender, erect, slightly ribbed. Leaves 2-3, filiform, 0.5-0.75 mm. wide, semi-cylindric, canaliculate, scabrid on the margin, congregated at the base

²¹ ["Almost hemispherical" is perhaps meant here. —Translator's note.]

of the scape, more than half as long as the scape. Spathe half as long as the umbel, shortly acuminate, persistent. Umbel fasciculate or more often hemispherical, \pm few-flowered, dense; pedicels equal, equalling or $1\frac{1}{2}$ times (to twice) as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured with an inconspicuous nerve, 4-5 mm. long, obtuse, oblong-elliptic, the outer ones somewhat shorter than the inner. Filaments equalling or somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate from a somewhat expanded base, the inner twice as broad, with teeth above the base, more rarely almost entire. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VIII. (Tab. X, fig. 3 a).

In salt-marshy places.—E. SIBERIA: 33 Dauria; C. ASIA: 42 Dzung.-Tarb. (Tarbagatai). Gen. distr.: Mongolia. Described from the R. Argun. Type at Leningrad.

NOTE. In the Tarbagatai (Tasbeit Kuduk—Ters Airyk) was collected the var. *Prezewalskii* Regel in A. H. P. III, 2 (1875) 163, et [ut var. “*Prezewalskianum*”] X (1887) 339, t. 4, f. 1. This variety is distinguished by its larger flowers (6 mm.), umbels of greater size, filaments of the inner stamens expanded [widened] almost half-way, and more abundant rufescent or rufous envelopes of the bulbs; it requires further study.

48. *A. BIDENTATUM* *Fischer ex Prokhanov* in Mater. Izuch. [Study] Mong. . . . 2 (1929) 83, in adn., et in Bull. Jard. Bot. Princ. U R S S XXIX (1930) 564, fig. 5.—*A. tenuissimum* Turchaninov in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 126, excl. syn.—*A. omiostema* Airy-Shaw in Notes Bot. Gard. Edinb. XVI (1931) 144.—Ic.: Prokhanov, l. c.; [Airy-Shaw in Hook. Ic. Plant. XXXII (1933) t. 3181].—Exs.: Karo, Pl. Daur. no. 120, sub *A. tenuissimo*.

Roots numerous, almost cord-like. Bulbs crowded a few together and attached to a horizontal rhizome, forming with the sterile ones a fairly dense tuft, almost cylindric, c. 0.5 cm. thick, with brownish almost coriaceous envelopes split into parallel laciniae. Scape 10-25 cm. high, slender, erect, ribbed. Leaves 3, congregated at the base of the scape, semicylindric, canaliculate, 1-1.5 mm. thick, scabrid on the margin, somewhat shorter than the scape. Spathe half as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, more rarely almost spherical, few-flowered, dense; pedicels equal, equalling or $1\frac{1}{2}$ times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth deep-rose with an inconspicuous nerve, 5-6 mm. long, the inner ones oblong-elliptic, almost linear-oblong, obtuse, almost truncate, the outer ones $\frac{1}{4}$ shorter than the inner, oblong-ovate, obtuse. Filaments somewhat shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad, bidentate at $\frac{2}{3}$ - $\frac{3}{4}$ of their height. Style not exserted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VI-VIII.

Rubbly and stony slopes.—E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 38 Ussuri (introduced); C. ASIA: 42 Dzung.-Tarb. (Tarbagatai). Gen. distr.: Mongolia. Descr. from Transbaikalia. Type at Leningrad.

49. *A. BELLULUM* Prokhanov in Bull. Gard. Bot. Princ. U R S S XXIX (1930) 568, t. 6.

Roots numerous, almost cord-like. Bulbs crowded a few together, attached to a horizontal rhizome, forming with the sterile ones a fairly dense tuft, almost cylindric, c. 0.5 cm. thick, with brownish envelopes split into parallel laciniae. Scape 7-20 cm. high, slender, erect, ribbed. Leaves 2, filiform, congregated at the base of the scape, c. 0.5 mm. wide, semicylindric, canaliculate, scabrid on the margin, somewhat shorter than the scape. Spathe $\frac{1}{3}$ as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, few-flowered, lax, with almost pendulous flowers; pedicels equal, $(1\frac{1}{2})$ -2 times as long as the perianth, slender, without bracteoles. Segments of the broadly campanulate perianth deep-rose, 3.5-4.5 mm. long, obtuse, ovate, the outer ones somewhat shorter than the inner. Filaments equalling the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad, bidentate two-thirds of the way up. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VII.

On stony steppes.—W. SIBERIA: 29 Alt. (valley of the R. Bukhtarma). Gen. distr.: Mongolia. Descr. from valley of the R. Turgan. Type at Leningrad.

NOTE. Very close to *A. bidentatum*, and requires further study.

50. *A. TENUISSIMUM* Linné Sp. Pl. (1753) 301; Ledeb. Fl. Ross. IV (1852) 183; Kryl. Fl. Zap. Sib. III (1929) 623.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) t. 358.—Exs.: H F R no. 1389.

Bulbs attached a few together to a horizontal rhizome, narrowly cylindric-conical, almost undifferentiated, with blackish or brownish, almost membranous, slightly split, almost entire envelopes. Scape 5-25 cm. high, slender, erect, terete, ribbed. Leaves 2-3, filiform, 0.5-1 mm. wide, semicylindric, canaliculate, smooth or scabrid, somewhat shorter than or equalling the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, persistent. Umbel hemispherical, few-flowered, lax, with cernuous flowers; pedicels almost equal, $1\frac{1}{2}$ -2-(3) times as long as the perianth, without bracteoles. Segments of the hemispherical perianth whitish or rosy, c. 4 mm. long, truncate or very obtuse, the inner ones obcuneiform, the outer somewhat shorter than the inner, almost round-elliptic. Filaments almost $\frac{1}{3}$ shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad, almost triangular. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

On rocks, and stony and rubbly slopes.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan. Endemic (?). Descr. from Siberia.

51. *A. ANISOPodium* Ledebour, Fl. Ross. IV (1852) 183; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 126; Kryl. Fl. Zap. Sib. III (1929) 622; Kom. Opred. Rast. Dalnevost. Kraya, I (1931) 366.²²—Ic.: Komarov, l. c. t. 112, f. II.

Bulbs attached a few together to a horizontal or ascending rhizome, narrowly cylindro-conical, almost undifferentiated, with blackish-brown or brownish envelopes, \pm split, sometimes almost into fibres. Scape 20-40 cm. high, slender, erect, terete. Leaves 2-3, semicylindric, canaliculate, c. 1 mm. wide, smooth, somewhat shorter than the scape. Spathe shortly acuminate, $1/3$ - $1/2$ as long as the umbel, persistent. Umbel fasciculate or fasciculate-spherical, \pm many-flowered, lax; pedicels unequal, 3-7 times as long as the perianth, without bracteoles, the outer ones somewhat ascending. Segments of the broadly campanulate perianth rosy with an inconspicuous nerve, 3.5-4.5 mm. long, obtuse or truncate, the inner ones obcuneiform or inversely linear-cuneiform, the outer ones oblong-elliptic or broadly elliptic, somewhat shorter than the inner. Filaments $2/3$ as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad, almost triangular. Style scarcely exerted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

On dry slopes and sands.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri; C. ASIA: 41 Balkhash (N. E. part). Gen. distr.: Mongolia, Japan-China. Descr. from Transbaikalia. Type at Leningrad.

52. *A. CAESPITOSUM* Sievers ex Bongard et Meyer in Bull. Scient. Acad. Pétersb. VIII (1841) 341; Ledeb. Fl. Ross. IV (1852) 183; Kryl. Fl. Zap. Sib. III (1929) 622.—Ic.: Bongard et Meyer in Mém. Acad. Pétersb. VI, sér. IV, 228 (1845) t. 16.

Forming lax tufts, owing to its long runners, which are up to 10 cm. long. Bulbs almost undifferentiated, but distinguished by their bright greyish-brownish, membranous, split envelopes, the inner ones white. Scape 15-20 cm. high, terete. Leaves 4-6, congregated at the base of the scape, semicylindric, canaliculate, c. 1 mm. wide, smooth, shorter than the scape. Spathe $1/2$ as long as the umbel, shortly acuminate, persistent. Umbel hemispherical, few-flowered, \pm lax, with cernuous flowers; pedicels almost equalling, or $1\frac{1}{2}$ times as long as, the perianth, without bracteoles. Segments of the broadly campanulate, almost hemispherical perianth whitish, sometimes with a rosy tinge, 6-7 mm. long, obtuse, the inner ones broadly elliptic, somewhat longer than the outer ovate ones. Filaments $1/4$ - $1/3$ shorter than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, the outer ones

²² [To the synonymy of this species can be added *A. tenuissimum* var. *anisopodium* (Ledeb.) Regel in A. H. P. III, 2 (1875) 157. For notes on the *A. tenuissimum* group, see Airy-Shaw in Notes Roy. Bot. Gard. Edinburgh, XVI (1931) 144-6.—W. T. S.]

subulate, the inner almost 3 times as broad, subulate from a triangular base, almost narrowly triangular. Style not exserted from the perianth. Capsule somewhat shorter than the perianth. VI-VIII.

On sands.—C. ASIA: 41 Balkhash (Irtysh, Kurtu). Gen. distr.: Dzung-Kashg. (?). Descr. from the Picket [Piketny] fishing station on the Irtysh.²³ Type at Leningrad.

53. *A. OBLIQUUM* *Linné*, Sp. Pl. (1753) 296; Ledeb. Fl. Ross. IV (1852) 173; Schmalh. Fl. II (1897) 492; Kryl. Fl. Zap. Sib. III (1929) 614.—Ic.: Redouté, Lil. VII (1812) t. 364.—Exs.: Schultz, Herb. Norm. nov. ser. no. 2390.

Bulb solitary, attached to a vertical rhizome, oblong-ovoid, 2-3 cm. thick, with coriaceous reddish-brown envelopes. Scape robust, 60-100- (150) cm. high, clothed up to half-way with smooth leaf-sheaths. Leaves 6-9, linear, 5-20 mm. wide, gradually narrowed towards the apex, flat, subobtuse, smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel. Umbel spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth greenish-yellow, 4-5 mm. long, ovate, subacute or obtuse, the outer ones somewhat shorter than the inner, cymbiform. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. IV-VII.

In meadows and on woodland slopes.—EUROPEAN PART: 14 Transvolga, 18 Lower Don (?);²⁴ W. SIBERIA: 26 Ob (S. E. part), 27 Upper Tob., 29 Alt.; E. SIBERIA: 32 Ang.-Sayan (W. part); C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (Fergana range). Gen. distr.: C. Eur., Dzhung.-Kashg. Descr. from Siberia.

54. *A. PLATYSPATHUM* *Schrenk*, Enum. Pl. Nov. I (1841) 7; Ledeb. Fl. Ross. IV (1852) 184; Kryl. Fl. Zap. Sib. III (1929) 614.—*A. amblyophyllum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 510.—*A. alataviense* Regel in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 448.—Ic.: Regel, Fl. Turk. (1876) t. 12, f. 4-6.

Bulbs 1-(2-3) together, attached to a vertical rhizome, almost cylindric, 1-2 cm. thick, with membranous white inner and black-brown

²³[Bongard and Meyer give the type-locality of *A. caespitosum* as "ad fl. Irtysh infra excubias Piketnaja-Rybalka dictas." Ledebour also cites it as occurring "in Sibiriae altaicae deserto soongorokirghisico (Sievers)" and Regel as occurring "in Dschungariae orientalis arenosis ad lacum Saissan-nor (Sievers)". All refer to the region of the Zaysan Nor Lake. The name *A. caespitosum* Sievers seems to have been first published in Pallas, Nord. Beytr. VII (1796) 304. —W. T. S.]

²⁴Novocherkassk, *Pabo* —requires confirmation.

papyraceous outer envelopes. Scape 10-70 cm. high, clothed at the base or up to half-way with smooth leaf-sheaths. Leaves 2-6, linear, 3-17 mm. wide, flat, obtuse, smooth, or more rarely scabrid on the margin, equaling or somewhat longer than the scape. Spathe shortly acuminate, sometimes coloured, somewhat shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, equaling or $1\frac{1}{2}$ times as long as the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rosy with an inconspicuous nerve, shining, 6-8 mm. long, almost equal, lanceolate or linear-lanceolate, subobtuse or subacute. Filaments somewhat shorter than, or up to $1\frac{1}{2}$ times as long as, the perianth-segments, connate at the extreme base and adnate to the perianth, equal, entire, subulate from a somewhat expanded base. Style strongly exserted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VI-VII.

In the alpine and subalpine mountain zones.—W. SIBERIA: 29 Alt.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al. (Pamir, Alai and Transalai ranges), 49 Tien Shan (C. Tien Shan, Alexander range, Talas Ala Tau). Gen. distr.: Dzung.-Kashg. Descr. from the Dzhilkaragai Alps. Type at Leningrad.

55. *A. POLYPHYLLUM* *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 509; Ledeb. Fl. Ross. IV (1852) 174.—Ic.: Regel, Fl. Turk. (1876) t. 12, f. 1-3.—Exs.: Herb. Fl. As. Med. no. 338.

Bulbs 1-2 together, attached to a vertical or obliquely ascending rhizome, broadly cylindric-conical, 1.5-2.5 cm. thick, with brown, coriaceous, entire, non-shining envelopes. Scape robust, 20-60 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 5-7, broadly linear, 3.5-15 mm. wide, flat, obtuse, generally falcately recurved, almost smooth on the margin, shorter than the scape. Spathe shortly acuminate, equaling the umbel, sometimes coloured. Umbel spherical, more rarely hemispherical, dense, many-flowered; pedicels equal, equalling or up to twice as long as the perianth, without bracteoles at the base. Segments of the ovoid-campanulate perianth rosy with an inconspicuous nerve, 5-8 mm. long, obtuse, the outer ones oblong or oblong-ovate, slightly or $\frac{1}{4}$ shorter than the obovate or oblong-obovate inner ones. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate from an expanded base, the inner ones twice as broad. Style strongly exserted from the perianth. Capsule almost $\frac{1}{3}$ shorter than the perianth. VII-VIII.

On rubbly and stony slopes in the subalpine and alpine mountain zones.—C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Described from the Dzungarian Ala Tau, from the R. Sarkhan. Type at Leningrad.

56. *A. HYMENORRHIZUM* *Ledebour*, Fl. Alt. II (1830) 12; Ledeb. Fl. Ross. IV (1852) 184; Boiss. Fl. Or. V (1882) 248; Kryl. Fl. Zap. Sib. III (1929) 615.—*A. macrorrhizum* Boissier, Diagn. Pl. Or. I, 13 (1853) 32.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833) tab. 359.—Exs.: Herb. Fl. As. Med. no. 58.

Bulbs 1—few together, attached to a rhizome, forming a fairly dense tuft, cylindro-conical, (1)-1.5-2 cm. thick, with numerous, coriaceous, brown, splitting envelopes. Scape 30-90 cm. high, clothed almost half-way with smooth distant sheaths. Leaves 4-6, linear, 2-5 mm. wide, flattish, generally erect, smooth, somewhat shorter than the scape. Spathe shortly acuminate, somewhat shorter than or equalling the umbel, persistent. Umbel spherical or more rarely hemispherical, many-flowered, dense; pedicels equal, $1\frac{1}{2}$ -2-(3) times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth rosy with an inconspicuous nerve, 4-6 mm. long, subobtuse or subacute, the outer ones lanceolate or oblong-lanceolate, somewhat shorter than the oblong or oblong-elliptic inner ones. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. VII-VIII.

In meadows.—W. SIBERIA: 27 Upper Tob. (Iryndyk), 29 Alt.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Iran, Dzung.-Kashg. Descr. from the rivers Koksú and Uba in the Altai. Type at Leningrad.

57. *A. KASCHIANUM* Regel in A. H. P. X (1887) 338, t. 3, f. 2.

Bulbs 1-few together, attached to a rhizome, forming a rather lax tuft, almost cylindric, 1-1.5 cm. thick, with coriaceous, dark brown envelopes, splitting into narrow sections. Scape 15-40 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 4-5, narrowly linear, 1-3 mm. wide, flattish, scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or hemispherical, comparatively few-flowered, dense, almost capitate; pedicels equal, $\frac{2}{3}$ as long as or equalling the perianth, without bracteoles at the base. Segments of the campanulate perianth pale rosy-lilac with a strong darker nerve, c. 5 mm. long, subobtuse, the outer ones oblong-lanceolate, somewhat shorter than the oblong-elliptic inner ones. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, almost equal. Style strongly exserted from the perianth. Capsule equalling the perianth. VII-IX.

On meadow-steppe slopes of mountains.—C. ASIA: 49 Tien Shan (C. Tien Shan, rarely). Gen. distr.: Dzung.-Kashg. Descr. from the rivers Kash and Kegen. Type at Leningrad.

58. *A. GLACIALE* Vvedensky in Bull. Univ. As. Centr. 19 (1934) 121.

Bulb solitary, attached to an ascending rhizome covered with the remains of bulbs of former years, conical, 0.75-1 cm. thick, 2-3 cm. long, with yellowish-brownish, coriaceous envelopes, which are entire or sometimes split into fibres. Scape 20-30 cm. high, thickish, terete, smooth, scarcely ribbed, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth distant leaf-sheaths. Leaves 3-4, linear, 2-3 mm. wide, flat, smooth on the margin or finely scabrid, apparently shorter than the scape. Spathe shortly acuminate, equalling the umbel or somewhat longer than it, persistent.

Umbel spherical, many-flowered, dense, capitate; pedicels equal, equalling or somewhat longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a strong purple nerve, *c.* 4 mm. long, linear-oblong, very obtuse, the outer ones somewhat shorter than the inner. Filaments somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, the inner ones somewhat broader. Style exserted from the perianth. VII.

C. ASIA: 48 Pam.-Al. Found once by Drobov in the Turkestan Range on a stony southern slope towards the Zeravshan glacier. Endemic. Type at Tashkent.

59. *A. SETIFOLIUM* *Schrenk*, Enum. Pl. Nov. I (1841) 6; Ledeb. Fl. Ross. IV, (1852) 172.—Ic.: Regel, Fl. Turk. (1876) t. 11, f. 1-3.

Bulbs usually numerous, attached to a rhizome, forming a dense tuft, elongate, ovoid, more often almost cylindric, 0.5-0.75 cm. thick, 2-3 cm. long, with coriaceous, yellowish-brownish, entire envelopes splitting above. Scape slender, 5-10 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2, capillary, smooth, almost equalling the scape. Spathe acuminate, small, several times shorter than the umbel, persistent. Umbel fasciculate, few-flowered, lax; pedicels almost equal, equalling or twice as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a darker nerve, 6-7 mm. long, almost equal, linear-lanceolate, subobtuse. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate, and adnate to the perianth, almost halfway, entire, subulate from a somewhat expanded base, almost equal. Style not exserted from the perianth. Capsule $\frac{1}{3}$ shorter than the perianth. VI-VII.

In stony country in foothills.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 49 Tien Shan (Trans-Ilian Ala Tau, Chu-Ili Mts.). Gen. distr.: Dzung.-Kashg. Descr. from Labasa. Type at Leningrad.

60. *A. SUBTILISSIMUM* *Ledebour*, Fl. Alt. II (1830) 22; id. Fl. Ross. IV (1852) 173; Kryl. Fl. Zap. Sib. III (1929) 612.—Ic.: Ledebour, Ic. Pl. Fl. Ross. IV (1833) t. 360.

Bulbs elongate-conical, 0.75-1 cm. thick, packed into an easily disintegrating tuft, with almost coriaceous greyish-brown envelopes. Scape 5-20 cm. high, slender, erect. Leaves 3-4, filiform, *c.* 0.5 mm. wide, semi-cylindric, canaliculate, scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe small, half as long as the umbel, with a beak equalling the base of the spathe, persistent. Umbel fasciculate or hemispherical, few-flowered, very lax; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base, the outer ones ascending. Segments of the almost stellate perianth rosy-purple with a darker nerve, *c.* 4 mm. long, elliptic, obtuse, equal, the outer ones concave. Filaments purple, somewhat longer than the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style longer than the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

In salt-marshes and on stony slopes.—W. SIBERIA: 28 Irt.; C. ASIA: 41 Balkash, 42 Dzung-Tarb. Gen. distr.: Mongolia. Descr. from the R. Irtysh. Type at Leningrad.

NOTE. The indications for the Urals and Pamir-Alai are erroneous.

61. *A. JUCUNDUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs apparently attached, a few together, to a short rhizome, cylindric-conical, 0.5-1 cm. thick, with brown, almost coriaceous, \pm entire envelopes. Scape 10-15 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 1-1.5 mm. wide, smooth, almost equalling the scape. Spathe persistent, somewhat shorter than the umbel, uncoloured, without a beak. Umbel hemispherical, few-flowered, lax; pedicels equal, equalling or somewhat longer than the perianth, without or with a few bracteoles at the base. Segments of the campanulate perianth purple with a darker nerve, c. 5 mm. long, oblong, subobtuse, almost equal. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, purple, subulate, entire, equal. Style exserted from the perianth. VII.

On rocks.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from Ulakhol. Type at Leningrad.

NOTE. To a certain extent related to the high-mountain species of the *A. globosum*, s.l., group, but differs from all of them in the beakless spathe and flat leaves. Related, but perhaps more distantly, to *A. Pevtzovi* Prokh., which differs from it in the long filaments and general flower-structure of the *A. globosum* group.

62. *A. TYTTHANTHUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs attached a few together to a short rhizome, ovoid-conical or elongate-conical, c. 1 cm. thick, with brown, coriaceous, entire envelopes. Scape 10-15 cm. high, clothed at the base or almost half-way with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, hispid, apparently somewhat shorter than the scape. Spathe persistent, scarcely more than half as long as the umbel, with a short beak sometimes equalling half the base of the spathe. Umbel fasciculate-spherical, few-flowered, lax; pedicels equal, ($1\frac{1}{2}$)-2 times as long as the perianth, slender, with cernuous flowers, with bracteoles at the base. Segments of the hemispherical perianth pale-yellowish, becoming rosy, c. 3 mm. long, elliptic, obtuse, the inner ones with a short apiculus, somewhat longer than the outer. Filaments $1\frac{1}{2}$ times as long as the perianth, connate at the extreme base and adnate to the perianth, subulate, entire, equal. Style exserted from the perianth. VII.

On rocks and stony slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. (Chulbair Mts.). Endemic. Descr. from the Chulbair Mts.: Khodzaha Barku. Type at Tashkent.

NOTE. Collected at two very closely situated points in the Chulbair mountains. Differs from all species of the *A. globosum*, s.l., group, in the lax umbel with pendulous flowers.

63. *A. KOKANICUM* Regel in A. H. P. III, 2 (1875) 104.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 4-6.

Bulbs attached, a few together, to a short rhizome, cylindric-conical, 0.75-1.5 cm. thick, with brown, coriaceous, \pm entire envelopes. Scape 5-20-(40) cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-4, filiform, canaliculate, 0.5-1 mm. wide, ciliate-scabrid. Spathe persistent, equalling or more rarely somewhat longer than the umbel, with a beak equalling or twice as long as the base of the spathe. Umbel hemispherical or spherical, usually few-flowered, dense; pedicels equal, shorter than or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 4-5 mm. long, subacute, almost equal. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times as long as the perianth, connate at the extreme base and adnate to the perianth, \pm purple, the outer ones subulate, the inner $1\frac{1}{2}$ times as broad, bidentate at the base. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On stony and rocky slopes in the upper mountain zone.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Alai range), 49 Tien Shan (Alexander range, Fergana range). Endemic (?). Descr. from the Alai range. Type at Leningrad.

NOTE. A species with a curious distribution; related to *A. caricoides*, from which it differs in the toothed filaments of the inner stamens.

64. *A. FILIFOLIUM* Regel, A. H. P. X (1887) 352, t. 6, f. 3.

Bulbs attached, a few together, to a short rhizome, elongate-conical or almost cylindric, 0.5-1 cm. thick, with brown, coriaceous, \pm entire envelopes. Scape 10-20 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 2-3, filiform or almost capillary, 0.25-0.5-(1) mm. wide, canaliculate, smooth, or finely scabrid on the margin, somewhat shorter than the scape. Spathe persistent, somewhat longer than the umbel, with a beak shorter than the base of the spathe or equalling it, generally coloured. Umbel hemispherical, more rarely spherical, few-flowered, dense; pedicels equal, half as long as, equalling, or rarely $1\frac{1}{2}$ times as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, (4)-5 mm. long, oblong, subacute, almost equal. Filaments $1\frac{1}{2}$ times or almost twice as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, equal, subulate, generally slightly coloured. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

Rubbly and stony slopes in the upper mountain zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from the Talas Ala Tau: Bish Tash. Type at Leningrad.

Note. In the Talas Ala Tau and the Alexander range is found the typical *A. filifolium* with smooth almost capillary leaves; in the remaining part of the area (Tashkent Ala Tau, Pamir-Alai) specimens frequently occur with broader, scabrid leaves, in this respect approaching *A. caricoides* Regel.

Further collections are needed of the high-mountain, Central Asiatic onions of the *A. globosum*, s. l., group, since there is often incomplete material from the most interesting parts of their areas.

65. *A. CARICOIDES* Regel in A. H. P. VI (1880) 532.—*A. Hoeltzeri* Regel, A. H. P. VIII (1884) 657 et in Gartenfl. (1884) 291, t. 1169.—Ic.: Regel in A. H. P. X (1887) t. 6, f. 2 [et in Gartenfl. l. c.].

Bulbs attached, a few together, to a short rhizome, cylindric-conical, 0.5-1 cm. thick, with brown, coriaceous, \pm entire envelopes. Scape 5-20 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, ciliate-scabrid on the margin, generally longer than the scape. Spathe persistent, slightly shorter or slightly longer than the umbel, with a beak slightly shorter or slightly longer than the base of the spathe, coloured. [Umbel . . . ?]; pedicels equal, half as long as or equalling the perianth, with bracteoles at the base. Segments of the campanulate perianth pale-rose with a purple nerve, 4.5 mm. long, oblong, acute, almost equal. Filaments $1\frac{1}{2}$ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, equal, subulate, \pm purple. Style exserted from the perianth. Capsule somewhat shorter than it. VI-IX.

Rubbly slopes of the intermediate and upper mountain zones.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic (?). Descr. from the Trans-Ilian Ala Tau: Malaya [Little] Almatinka. Type at Leningrad.

Note. Known from a few points in the Central Tien Shan, and requires further study. It is practically intermediate between *A. filifolium* Regel and *A. tianschanicum* Rupr.

66. *A. TIANSHANICUM* Ruprecht in Mém. Acad. Pétersb. sér. 7, XIV, 4 (1869) 33.—*A. hymenorhizum* var. *thianschanicum* Regel in A. H. P. III, 2 (1875) 132.—*A. macrorhizon* Regel in A. H. P. III, 2 (1875) 154.—*A. globosum* var. *albidum* Regel in A. H. P. X (1887) 352.—Ic.: Regel, Fl. Turk. (1876) t. 13, f. 12-14.

Bulbs attached, a few together, to a short rhizome, cylindro-conical or almost cylindric, (0.75)—1-2 cm. thick, (5)—10-15 cm. long, with brown, coriaceous, \pm splitting envelopes. Scape 15-25 cm. high, clothed at the base with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-1.5 mm. wide, canaliculate, ciliate-scabrid, generally shorter than the scape. Spathe persistent, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel hemispherical or almost spherical, \pm many-flowered, dense; pedicels equal, slightly shorter or slightly longer than the perianth, with bracteoles at the base. Segments of the almost spherical perianth yellowish, (?or) whitish,²⁵ becoming reddish, 5-6 mm. long, ovate, obtuse, the outer ones sometimes emarginate, one-sixth shorter than the inner. Filaments $1\frac{1}{4}$ or $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and

²⁵ ["Yellowish-white" is perhaps intended. —Translator's note.]

adnate to the perianth, subulate, entire, equal. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-IX.

On stony and rocky slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. (Alai range, Pamir), 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from Dzhaman Daban. Type at Leningrad.

Note. Judging from the herbarium, the Pamir-Alai and certain Tien Shan specimens have a yellowish tinge to the flowers. I myself have collected this species in the Terskei Ala Tau without the yellow tint in the flowers.

67. *A. CONDENSATUM* *Turchaninov* in Bull. Soc. Nat. Mosc. XXVII, 2 (1855) 121.—Kom. Opred. Rast. Dalnevost. Kraya I (1931) 365.—*A. Steveni* var. *e* Ledeb. Fl. Ross. IV (1852) 177.

Bulbs 1-(2) together, attached to a short rhizome, cylindro-conical, 1-2 cm. thick, with brown, often shining, thinly coriaceous, \pm entire envelopes. Scape 30-80 cm. high, clothed at the base or for one quarter with smooth leaf-sheaths. Leaves 4-7, semicylindric, canaliculate, fistular, 1-2.5 mm. wide, smooth, shorter than the scape. Spathe persistent, approximately equalling the umbel, with a beak sometimes equalling the base of the spathe. Umbel spherical or almost spherical, dense, many-flowered; pedicels equal, $(1\frac{1}{2})$ -2-3-(4) times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-yellow with a greenish nerve, 4-5 mm. long, ovate, subobtuse, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule slightly shorter than the perianth. VII-IX.

On accumulations of gravel and on rocks. —E. SIBERIA: 33 Dauria; FAR EAST: 36 Zeya-Bur., 38 Ussuri. Gen. distr.: Mongolia, Japan-China. Descr. from Dauria. Type at Leningrad.

68. *A. PETRAEUM* *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 512.—*A. Steveni* var. *d* Ledeb. Fl. Ross. IV (1852) 177.

Bulbs attached, 1-3 together, to a short rhizome, elongate-conical or almost cylindric, 0.75-1-1.5 cm. thick, with greyish (the inner often violet), coriaceous, almost papyraceous, splitting envelopes. Scape (20)-30-50 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with scabrid or smooth leaf-sheaths. Leaves 4-5, filiform, 0.5-1 mm. wide, canaliculate, generally smooth, somewhat shorter than the scape. Spathe persistent, 2-4 times longer than the umbel, with a beak several times exceeding the base of the spathe. Umbel spherical, dense, many-flowered; pedicels equal, $1\frac{1}{2}$ times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-yellow, with a greenish or more rarely dirty-green nerve, c. 4 mm. long, oblong-ovate, obtuse with a short apiculus, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ -2 times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule somewhat shorter than the perianth. VII.

Stony slopes in the foothills.—C. ASIA: 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan (Chu-Ili Mts.). Endemic. Descr. from the Dzungarian Ala Tau: Lepsa. Type at Leningrad.

69. *A. TALASSICUM* Regel in A. H. P. V (1878) 628.

Bulbs attached, 1-3 together, to a short rhizome, cylindric-conical, 0.75-1.5 mm. thick, with brown, coriaceous, almost entire envelopes. Scape (15)-30-75 cm. high, clothed for $\frac{1}{3}$ or nearly $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-7, narrowly linear or filiform, 0.5-1.5-(2) mm. wide, canaliculate, smooth, or scabrid on the margin. Spathe persistent, $1\frac{1}{2}$ -3 times as long as the umbel, with a beak $1\frac{1}{2}$ -5 times exceeding the base of the spathe. Umbel spherical or hemispherical, generally many-flowered, dense; pedicels equal, (1.5)-2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid perianth pale-yellowish, greenish, turning rose, oblong-lanceolate, acute, 3-4 mm. long, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style exserted from the perianth. Capsule somewhat longer than the perianth. VII-VIII. (Tab. XI fig. 2a).

On rocky and stony slopes in the intermediate mountain zone.—C. ASIA: 49 Tien Shan. Endemic. Descr. from Talas: Karachoku. Type at Leningrad.

70. *A. MARSCHALLIANUM*²⁶ Vvedensky, nom. nov.—*A. saxatile* Marschall-Bieberstein, Fl. Taur.—Cauc. I (1808) 264, Suppl. (1819) 260, non M. B. 1798 et auct. fl. Taur.—*A. Steveni* var. *g* Ledeb. Fl. Ross. IV (1852) 177.—*A. globosum* var. *ochroleucum* Boissier, Fl. Or. V (1882) 248, quoad pl. taur.—*A. globosum* var. *saxatile* Schmalhausen, Fl. II (1897) 493, p. p —Ic.: M. Bieb. Cent. Pl. Rar. (1810) t. 29.

Bulbs attached, a few together, to a short rhizome, elongate-conical, 0.75-1.5 cm. thick, with brown, coriaceous, splitting envelopes. Scape 10-35 cm. high, clothed at the base or for $\frac{1}{4}$ with smooth leaf-sheaths. Leaves 3-4, filiform, 0.5-1 mm. wide, canaliculate, smooth or scabrid, equalling or somewhat shorter than the scape. Spathe persistent, $1\frac{1}{2}$ -3 times as long as the umbel, with a beak several times as long as the base of the spathe. Umbel spherical or hemispherical, dense, generally many-flowered; pedicels equal, equalling or twice as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth white or scarcely rosy, scarcely yellowish in the herbarium, 4-5 mm. long, oblong-ovate, acute, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal; anthers generally yellow. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

²⁶ [Spelled *A. Marschalianum* by Vvedensky on p. 184 but *A. Marschallianum* on p. x. —W. T. S.]

On rocks, in stony localities and on mountain slopes.—EUROPEAN PART: 17 Crimea. Endemic (?). Descr. from the Crimea. Type at Leningrad.

NOTE. Very close to *A. saxatile* M. B., with which Bieberstein himself at first united it. Treating it as a distinct species, as has come to be done at the present time (cf., e. g., Wulff, Fl. Krym. 3, 34), I have been obliged to give it a new name, although I have no great faith in the differences of this species either from *A. saxatile* M. B. or from *A. szurulense* Lerchenf., if the latter indeed in its turn is distinct from *A. saxatile*.

71. *A. SAXATILE* *Marschall-Bieberstein*, Tabl. Prov. Casp. (1798) 114.—*A. savranicum* Besser, Cat. Hort. Crem. Suppl. (1818) (n. v.)—*A. caucasicum* *Marschall-Bieberstein*, Fl. Taur.-Cauc. Suppl. (1819) 258.—*A. Steveni* var. *b* *Ledeb.* Fl. Ross. IV (1852) 177.—*A. globosum* *Boiss.* Fl. Or. I (1884) 247, p. p.—*A. Ruprechtii* *Boissier*, Fl. Or. V (1882) 264 (?).—*A. globosum* var. *saxatile* *Schmalhausen*, Fl. II (1897) 493, p. p.—*A. globosum* f. *dilute-roseum* *Kryl.* Fl. Zap. Sib. III (1929) 632.—Exs.: Pl. Or. exs. no. 130, sub *A. globoso*.

Bulbs attached, a few together, to a short rhizome, ovoid-conical or elongate-conical, 0.75-1 cm. thick, with brown, coriaceous, splitting envelopes. Scape 20-50 cm. high, clothed at the base or for $\frac{1}{4}$ -($\frac{1}{3}$) with smooth or scabrid leaf-sheaths. Leaves 5-7, filiform, 0.5-1 mm. wide, canaliculate, smooth or scabrid, shorter than the scape. Spathe persistent, $1\frac{1}{2}$ -3 times as long as the umbel, with a beak generally several times exceeding the base of the spathe. Umbel hemispherical or spherical, generally many-flowered, dense; pedicels equal, equalling or more often $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth pale-rose, deeper on the back, 4-5-(6) mm. long, oblong, acute, the outer ones somewhat shorter than the inner. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, equal, subulate; anthers usually violet. Style exserted from the perianth. Capsule scarcely shorter than the perianth. VII-VIII.

On rocks, in stony places, on sands and steppes.—EUROPEAN PART: 12 Middle Dnepr, 16 Black Sea, 17 Crimea, 18 Lower Don (W. part); CAUCASUS: 20 Ciscauc., 21 Dag., 22 W. and 23 E. Transcauc.; C. ASIA: 41 Balkhash (N. E. part), 42 Dzung.-Tarb. Gen. distr.: C. Europe, Dzung.-Kashg. Descr. from E. Transcauc.: Kurt Bulak.

Note. The difference in the habitats of the Ukrainian (sands and steppes) and Caucasian (rocks and stony slopes) plants, and also the great discontinuity of the Dzungaro-Tarbagatai locality, lead one to suppose that one is here dealing with distinct races, but it has not been possible to decide this point from herbarium material alone. The high-mountain Caucasian form with larger flowers also requires further study.

72. *A. GLOBOSUM* *Marschall-Bieberstein ex Redouté*, Lil. III (1807) t. 179; *Boiss.* Fl. Or. V. (1884) 247, p. p.; *Schmalh.* Fl. II (1897) 493,

p. p.; Kryl. Fl. Zap. Sib. III (1929) 631.—*A. caucaseum*²⁷ Ker-Gawler, Bot. Mag. XXVIII (1808) in adn. ad tab. 1143 (?).—*A. Steveni* var. *a* Ledeb. Fl. Ross. IV (1852) 176.—*A. Gmelinianum* Mishchenko ex Grossheim, Fl. Cauc. I (1928) 269.—Exs.: H F R no. 536.

Bulbs attached, usually a few together, to a short rhizome, ovoid-cylindric or elongate-conical, 0.75-1.5 cm. thick, with brown, coriaceous, splitting sheaths. Scape 20-60 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 5-6, subulate, 0.5 mm. wide, canaliculate, smooth or more rarely scabrid, shorter than the scape. Spathe persistent, usually 2-3-(4) times as long as the umbel, with a long beak usually several times exceeding the base of the spathe. Umbel usually spherical, more rarely hemispherical, dense; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth deep-rose, almost purple, with a darker nerve, 4-4.5 mm. long, oblong-ovate, acute, the outer ones scarcely shorter than the inner. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, entire, subulate, equal; anthers violet. Style exserted from the perianth. Capsule equalling the perianth. VI-VIII.

On stony slopes, on chalk and limestone, and in salt-marshes.—EUROPEAN PART: 10 Volga-Kama, 13 Volga-Don, 14 Transvolga, 17 Crimea (?), 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 41 Balkhash (N. E. part). Endemic. Descr. from the Caucasus.

73. A. ALEXANDRAE *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 95.

Bulbs attached, a few together, to an oblique rhizome, elongated-ovoid or almost cylindric, 0.75-1.5 cm. thick, 2-6 cm. long, with coriaceous entire envelopes, lacerate, and bearing parallel venation, only at the top. Scape (10)-20-30 cm. high, clothed up to half-way with smooth or scabrid leaf-sheaths. Leaves 4-5, filiform, c. 0.5 mm. wide, semi-cylindric, canaliculate, striate, smooth or scabrid, usually shorter than the scape. Spathe small, with a long beak sometimes 3 times exceeding the umbel, persistent. Umbel hemispherical, few-flowered, dense; pedicels almost equal, half as long as, equalling, or (in fruit) twice as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 4-5 mm. long, obtuse, the inner ones oblong-elliptic, somewhat longer and distinctly broader than the oblong-lanceolate outer ones. Filaments scarcely shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, the outer ones oblong-subulate, the inner 3 times as broad, at $\frac{3}{4}$ of the way

²⁷ [Spelled *A. caucasicum* by Vvedensky. The name *A. caucaseum* was published by Ker-Gawler in 1808 as a new name for the plant with deep rose flowers and purplish anthers figured in Bot. Mag. t. 973 (1806) as "*A. paniculatum*." W. T. S.]

up suddenly narrowed, sometimes almost dentate. Style not exerted from the perianth. Capsule somewhat shorter than the perianth. VII-VIII.

On steppe slopes.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from a few localities in the Central Tien Shan. Type at Leningrad.

74. *A. TERETIFOLIUM* Regel in A. H. P. V (1878) 629.—*A. Grimmii* Regel in Trautv., Regel, Maxim. et Winkl. Dec. Pl. Nov. (1882) 10.

Bulbs attached, 2 to a few together, to a short rhizome, elongated-ovoid, 1-1.5 cm. thick, with brown or rufescent-brown, coriaceous, reticulate-nerved (the outer reticulate-fibrous) envelopes, surrounding the base of the scape. Scape 15-50 cm. high, clothed for $\frac{1}{4}$ or $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4, filiform, c. 0.5 mm. wide, canaliculate, striate, smooth, shorter than the scape. Spathe with a beak $1\frac{1}{2}$ times exceeding the base of the spathe, equalling the umbel or somewhat shorter than it, persistent. Umbel fasciculate or more often fasciculate-hemispherical, generally many-flowered; pedicels \pm unequal, equalling or more often $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, 6-9 mm. long, almost equal, lanceolate, subacute. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{5}$, usually entire, the outer ones triangular-subulate, the inner three times as broad at the base, triangular. Style not exerted from the perianth. Capsule half as long as the perianth. VII-VIII.

Rubbly slopes.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), Tien Shan (Ketmen). Gen. distr.: Dzung.-Kashg. Descr. from the Dzungarian Ala Tau: Altyn Imel.

75. *A. KOROLKOWI* Regel in A. H. P. III, 2 (1875) 158.—*A. oliganthum* var. *elongatum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 511.—*A. moschatum* var. *dubium* et var. *brevipedunculatum* Regel, A. H. P. VI (1880) 522, 523.—*A. oliganthum* auct. fl. As. Med.—Ic.: Regel, Fl. Turk. (1876) t. 13-15.

Bulbs attached, 2 to a few together, to a short rhizome, oblong-ovoid, 0.75-1-(1.5) cm. thick, with coriaceous, brown, often shining, densely-, often almost reticulately-nerved envelopes, embracing the base of the scape and there slightly reticulate-fibrous. Scape slender, 10-20-(45) cm. high, clothed at the base or for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2-4, filiform, c. 0.5 mm. wide, striate, canaliculate, smooth or more rarely scabrid, distinctly shorter than the scape. Spathe with a short beak, sometimes equalling half the base of the spathe, somewhat shorter than the umbel, persistent.²⁸ Umbel fasciculate or hemispherical, usually few-flowered; pedicels \pm unequal, somewhat shorter than,

²⁸ [Owing to errors in punctuation, the original of this passage reads as follows: "spathe . . . shorter than the umbel; persistent umbel fasciculate. . . ." —Translator's note.]

equalling, or twice as long as, the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white, in the herbarium rosy with a purple nerve, 5-8 mm. long, almost equal, lanceolate or oblong-lanceolate, subacute or sometimes shortly acuminate. Filaments $\frac{2}{3}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, generally entire, abruptly subulate from a triangular base which in the inner ones almost twice as broad. Style not exerted from the perianth. Capsule half as long as the perianth. VII-VIII.

On dry steppe slopes.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 48 Pam.-Al. (Irkeshtam), 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from the mountains between the Little Naryn and Ulan. Type at Leningrad.

76. *A. ALBOVIANUM* *Vvedensky*, nom. nov.—*A. gracile* Albov in Tr. Tifl. Bot. Sada I (1895) 239, non Ait. (1789).

Bulbs attached, 2-3 together, to a rhizome, narrowly conical, c. 0.75 cm. thick, with brownish, coriaceous, fibrously splitting, indistinctly reticulate-fibrous envelopes. Scape 20-30 cm. high, ribbed, clothed at the base with \pm approximate smooth leaf-sheaths. Leaves 3-5, narrowly linear, c. 2 mm. wide, thickish, canaliculate, smooth or very finely scabrid on the margin, somewhat shorter than the scape. Spathe with a short beak, somewhat shorter than the umbel, persistent. Umbel hemispherical, \pm few-flowered, dense; pedicels equal, approximately equalling the perianth. [Segments of the . . . perianth] deep-rose with an inconspicuous nerve, 5-6 mm. long, elliptic, obtuse, the outer ones somewhat shorter than the inner. Filaments deep-rose, $1\frac{1}{2}$ times as long as the perianth, connate at the extreme base and adnate to the perianth, entire, subulate, equal. Style scarcely exerted from the perianth. VII.

Alpine pastures.—CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Mt. Dzhvari.

77. *A. GUNIBICUM* *Mishchenko ex Grossheim*, Fl. Kavk. I (1928) 208.

Bulbs attached, a few together, to a short rhizome, ovoid-conical or elongate-conical, 0.5-0.75 cm. thick, (1)-2-7 cm. long, with brown, coriaceous, splitting, obscurely reticulate-fibrous envelopes. Scape 10-20 cm. high, slender, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, smooth, 0.5-1 mm. wide, approximately equalling the scape. Spathe with a long beak, equalling or slightly shorter than the base of the spathe, somewhat shorter than the umbel, persistent. Umbel fasciculate-hemispherical, or hemispherical, few-flowered, lax; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, with a few bracteoles at the base. Segments of the hemispherical perianth rose-purple, c. 5 mm. long, elliptic, obtuse. Filaments rose, $1\frac{1}{2}$ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, subulate, equal. Style exerted from the perianth. Capsule somewhat shorter than the perianth. VIII.

On rocks and stony slopes, 1300-2000 m.—CAUCASUS: 21 Dag. Endemic. Descr. from Gunib. Type at Leningrad.

NOTE. Near the village of Gimra [? Himra], on limestone, at an altitude of about 700 m., an onion was collected by A. Poretsky which comes very near to this species, but differs in its smaller (c. 4 mm.) narrower, apiculate perianth-segments.

A. gunibicum is very close to *A. Albovianum*, and their differences are not altogether clear to me, since I only know the latter species from cultivated specimens.

78. *A. DAGHESTANICUM* *Grossheim*, Fl. Kavk. I (1928) 208.

Bulbs ovoid-lanceolate, attached to a rhizome, with grey slightly reticulate-fibrous envelopes. [Scape . . . ?] Leaves shorter than the scape, thick, flat, canaliculate, 4-5 mm. wide. Spathe shorter than the pedicels, with a subulate tip. Umbel few-flowered, lax; pedicels unequal, 4-6 times as long as the flowers. Perianth-segments rose-coloured, 5-7 mm. long, acute, ovate-lanceolate, the outer ones lanceolate. Filaments $1\frac{1}{2}$ times as long as the perianth-segments; anthers dark. Style somewhat longer than the ovary.

High-mountain zone.—CAUCASUS: 21 Dag. Endemic. Type at Tiflis.

79. *A. WESCHNIAKOWI* *Regel* in A. H. P. VI (1880) 531.—Ic.: *Regel* in A. H. P. X (1887) t. 8, f. 3.

Roots numerous, almost cord-like. Bulbs crowded a few together, attached to a horizontal rhizome, scarcely differentiated, with greyish-brownish, membranous, \pm entire envelopes. Scape 10-15 cm. high, slender, erect, ribbed. Leaves 2-3, subulate,²⁹ 0.5-1 mm. wide, semicylindric, canaliculate, smooth, somewhat shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, persistent; umbel fasciculate, few-flowered, fairly lax; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, without bracteoles. Segments of the campanulate perianth rosy-violet with a strong dirty-violet nerve, 5-6 mm. long, oblong-elliptic, obtuse, the outer ones somewhat shorter than the inner. Filaments $\frac{1}{4}$ - $\frac{1}{3}$ shorter than the perianth-segments, adnate half-way to the perianth and connate for almost $\frac{3}{4}$, the outer ones subulate above the level of concrescence, the inner narrowly triangular. Style not exerted from the perianth. Capsule scarcely more than half as long as the perianth. VI-VII.

On gravelly and rubbly and stony slopes in the alpine region.—C. ASIA: 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from the R. Kegen. Type at Leningrad.

80. *A. SEMENOVII* *Regel* in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 449.—Ic.: *Regel*, Fl. Turk. (1876) t. 8, 4-5.

Bulbs attached, 1 to a few together, to a rhizome, cylindric, scarcely differentiated, 0.75-1 cm. thick, with brownish, almost reticulate-fibrous envelopes. Scape thickish, 10-40 cm. high, clothed half-way or almost half-way with smooth approximate leaf-sheaths. Leaves (2)-3, broadly linear, 5-15 mm. wide, gradually narrowed towards the apex, not fistular,

²⁹ [Probably a slip for "filiform". —Translator's note.]

canalicate, smooth, somewhat longer than the scape. Spathe shortly acuminate, approximately equalling the umbel, generally coloured, persistent. Umbel spherical-ovoid, \pm few-flowered, dense, capitate; pedicels unequal, the outer ones several times shorter than the inner, somewhat shorter than or equalling the perianth, without bracteoles at the base. Segments of the campanulate perianth yellow, becoming reddish later, 10-15 mm. long, unequal, the outer ones $1\frac{1}{2}$ times as long, lanceolate or oblong-lanceolate, attenuate, acute, \pm denticulate. Filaments $\frac{1}{4}$ - $\frac{1}{3}$ as long as the outer perianth-segments, adnate half-way to the perianth and connate for $\frac{3}{4}$, triangular-subulate above the level of concrescence, the inner ones twice as broad, generally bidentate. Style not exerted from the perianth, with 3 stigmata, sometimes divided almost to the base. Capsule scarcely more than $\frac{1}{3}$ as long as the perianth. VI-VII.

In alpine meadows.—C. ASIA: 42 Dzung.-Tarb. (Dzungarian Ala Tau), 49 Tien Shan. Gen. distr.: Dzung-Kashg. Descr. from a few points in the Central Tien Shan. Type at Leningrad.

81. *A. MONADELPHUM*³⁰ Lessing ex Kunth, Enum. IV (1843) 393; Ledeb. Fl. Ross. IV, (1852) 168; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 120.—*A. atosanguineum* Schrenk, Bull. Acad. Pétersb. X (1842) 355; Ledeb. Fl. Ross. IV (1852) 168.—*A. atosanguineum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1852) 508.—*A. Fedtschenkoanum* Regel in A. H. P. III, 2 (1875) 82.—*A. Kaufmanni* Regel in A. H. P. III, 2 (1875) 84.—Ic.: Regel, Fl. Turk. (1876) t. 8, f. 1-3.

Bulbs solitary or crowded, attached to a rhizome, cylindric, scarcely perceptible, 0.5-1 cm. thick, with brownish, \pm fibrous, bast-like envelopes. Scape thickish, 10-60-(100) cm. high, clothed for $\frac{1}{5}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 1-2-(3), cylindric, fistular, 2-7 mm. wide, smooth, somewhat shorter or somewhat longer than the scape. Spathe shortly acuminate, equalling or somewhat shorter than the umbel, generally coloured, persistent. Umbel spherical-ovate, few-flowered, dense, often capitate; pedicels unequal, the inner ones longer than the outer, $\frac{1}{3}$ - $\frac{1}{2}$ as long as, equalling, or (the inner in fruit) twice as long as, the perianth, without bracteoles at the base. Segments of the campanulate perianth shining, yellow or later reddening or dark-purple, 7-14 mm. long, equal or the outer ones $1\frac{1}{2}$ times as long, lanceolate, oblong-lanceolate or oblong, often attenuate, obtuse or acute, entire or \pm denticulate. Filaments $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, adnate to the perianth almost half-way and connate for $\frac{2}{3}$ - $\frac{3}{4}$, triangular-subulate above the level of concrescence, the inner ones $1\frac{1}{2}$ times as wide, sometimes bidentate. Style not exerted from the perianth, with 3 stigmata, sometimes divided for $\frac{2}{3}$. Capsule half as long as the perianth. VI-VII.

In stony and earthy localities in the subalpine and alpine mountain zones.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria;

³⁰ [According to the synonymy here given, the correct name for this species should be *A. atro-sanguineum* Schrenk (or Kar. et Kir.), 1842. The dates of publication of the papers by Schrenk and by Karelin and Kirilov need investigation.—Translator's note.]

C. ASIA: 42 Dzung. —Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: India-Himal. Dzung.-Kashg., Mongolia. Descr. from W. Sayan: Sabin Daban. Type at Leningrad.

NOTE. *A. monadelphum* s. l. constitutes a very complex, exceedingly polymorphic cycle. For its successful analysis into elementary units it is especially necessary to have observations in the field, particularly on the colour of the flowers and on the degree of caespitoseness.

82. *A. SCHOENOPRASUM* Linné, Sp. Pl. (1753) 301; Ledeb. Fl. Ross. IV (1852) 166, excl. syn. *A. oliganthum* Kar. et Kir.; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 119; Boiss. Fl. Or. V (1882) 250; Schmalh. Fl. II (1897) 493; Kryl. Fl. Zap. Sib. III (1929) 606; Kom. Opred. Rast. Dalnevost. Kraya I (1931) 366.—*A. sibiricum* Linné, Mant. II (1771) 562.—*A. Raddeanum* Regel in A. H. P. III, 2 (1875) 155.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 235.—Exs.: H F R no. 85.

Bulbs attached, one to a few together, to a short rhizome, oblong-ovoid or ovoid-conical, 0.75-1 cm. thick, with brown, papyraceous, almost coriaceous, sometimes slightly parallel-fibrous envelopes. Scape thickish, 10-60 cm. high, smooth or more rarely scabrid, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth or more rarely scabrid leaf-sheaths. Leaves 1-2, cylindric or semicylindric at the base, 2-6 mm. wide, fistular, smooth or more rarely scabrid, generally shorter than the scape. Spathe shortly acuminate, equalling or somewhat shorter than the umbel, often coloured, persistent. Umbel fasciculate-spherical or almost spherical, dense, almost capitate; pedicels unequal, the inner ones longer, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, more rarely equalling them, without bracteoles at the base. Segments of the narrowly campanulate perianth shining, pale-rose to rose-violet, with a darker nerve, 7-17 mm. long, linear-lanceolate, lanceolate or oblong, \pm attenuate, acute or subobtuse, often with reflexed apiculi. Filaments $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{4}$ - $\frac{1}{3}$, entire, attenuate from a triangular base which is $1\frac{1}{2}$ times as broad in the inner ones. Style not exerted from the perianth. Capsule $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth. V-VIII.

In meadows, in river-valleys, more rarely on stony slopes.—ARCTIC: 1 Arct. Eur., 2 Nov. Zeml., 3 Arct. Sib., 4 Chukotsk, 5 Anadyr; EUROPEAN PART: 6 Karelian Lapl., 7 Dvina-Pechora, 8 Ladoga-Ilmen, 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr (rarely), 13 Volga-Don, 16 Black Sea (rarely), 18 Lower Don (rarely); CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 S. and 24 E. Transcauc.; W. SIBERIA: 26 Ob, 28 Irt., 29 Alt.; E. SIBERIA: 30 Yenisei, 31 Lena-Kolyma, 32 Ang.-Sayan, 33 Dauria; FAR EAST: 34 Kamch., 35 Okhotsk, 37 Udsch, 38 Ussuri; C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (C. Tien Shan). Gen. distr.: Scand., C. Eur., W. Medit., Balkans-Asia Min., Iran, India-Himal., Dzung-Kashg., Mongolia, Japan-China, Beringia, N. Amer. Descr. from Siberia and Oland.

NOTE. *A. Schoenoprasum*, as accepted here, represents a very polymorphic cycle.³¹ Especially deserving of interest for further study is the central Asiatic (strongly scabrid) race. Scabridity of scape and leaves sometimes appears also in the Caucasian *A. Schoenoprasum*; this has led certain writers on the Caucasian flora to identify such plants with *A. scabrellum* Boiss. et Buhse, which is quite erroneous.

ECONOMIC IMPORTANCE. Chives is sometimes cultivated in the western zone of the European part of the USSR for a tender pot-herb. In Siberia it is stored up salted for the winter.

83. *A. LEDEBOURIANUM* Roemer et Schultes, Syst. VII (1830) 1029; Ledeb. Fl. Ross. IV (1852) 168; Kryl. Fl. Zap. Sib. III (1929) 607.—*A. uliginosum* Ledeb. Ic. Pl. Fl. Ross. I (1829) 20, t. 83 [non G. Don (1827).—Ic.: Ledeb. Ic. l. c.].

Bulbs attached, 2-few together, to a rhizome, cylindric or elongate-ovoid, 0.75-1 cm. thick, with greyish-brown, crustaceo-coriaceous, disintegrating envelopes. Scape thickish, 40-80 cm. high, smooth, clothed half-way with smooth leaf-sheaths. Leaves 1-2, semicylindric (?), fistular, 5-10 mm. wide, smooth, shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate-spherical or almost spherical, many-flowered, dense; pedicels almost equal, $1\frac{1}{2}$ -3 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth shining, rosy-violet, with a darker nerve, 7-12 mm. long, oblong-lanceolate or lanceolate, acute. Filaments slightly or $\frac{1}{3}$ shorter than the perianth-segments, connate at the base and adnate to the perianth, entire, the outer ones triangular-subulate, the inner $1\frac{1}{2}$ times as broad at the base, very narrowly triangular. Style strongly exserted from the perianth. Capsule half as long as the perianth. VI-VII.

In meadows and river-valleys.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; FAR EAST: 36 Zeya-Bur., 37 Udsk. Gen. distr.: Mongolia. Descr. from the Byelaya [White] Uba and Koksun rivers. Type at Leningrad.

NOTE. The var. *intermedium* described by Krylov (Fl. Alt. VI (1912) 1379) is apparently a hybrid between *A. Ledebourianum* and *A. Schoenoprasum*.

84. *A. MAXIMOWICZI* Regel in A. H. P. III, 2 (1875) 153; Kom. Opr. Rast. Dalnevost. Kraya I (1931) 366.

Bulbs attached, a few together, to a rhizome, cylindro-conical, 0.75-1 cm. thick, with greyish, almost papyraceous, disintegrating envelopes.

³¹ [The polymorphism of *Allium Schoenoprasum* is dealt with at length by A. Levan, Zytologische Studien an *Allium Schoenoprasum* (Akademische Abhandlung, Lund; 1935).

Allium Raddeanum from Munko Sardik, Irkutsk region, west of Lake Baikal (E. Angaro-Sayan, no. 32) is a robust Siberian form 40-60 cm. high, with umbels 3-4 cm. across and flowers to 15 mm. long, apparently very similar to the tetraploid "Gigasform" introduced by Turesson from the shore of Lake Teletsker, Oiraten region (W. Angaro-Sayan, no. 32) and figured by Levan (loc. cit. figs 5, 6).—W. T. S.]

Scape 15-60 cm. high, clothed at the base or for $\frac{1}{3}$ with smooth, sometimes violet-tinted leaf-sheaths. Leaves 1-(2), cylindric (?), fistular, 1-5 mm. wide, smooth, somewhat shorter than the scape. Spathe shortly acuminate, somewhat shorter than the umbel, persistent. Umbel hemispherical or spherical, many-flowered, dense; pedicels almost equal, $(1\frac{1}{2})$ -2-(3) times as long as the perianth, without bracts at the base. Segments of the campanulate perianth shining, rose-coloured, with a darker nerve, 5-6-(7) mm. long, oblong-lanceolate, acute. Filaments slightly shorter or scarcely longer than the perianth-segments, connate at the base and adnate to the perianth, entire, the outer ones subulate from a somewhat expanded base, the inner almost $1\frac{1}{2}$ times as broad at the base, gradually narrowed from the base. Style somewhat exerted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VI-VII. (Tab. XI, fig. 3, 3a).

In meadows and river-valleys.—E. SIBERIA: 33 Dauria; FAR EAST: 35 Okhotsk, 36 Zeya-Bur., 37 Udsch, 38 Ussuri, 39 Sakh. Gen. distr.: Japan-China. Descr. from the Amur and Ussuri region. Type at Leningrad.

NOTE. Very close to *A. Ledebourianum*, and requires further study, since the differences between them are not altogether clear.

85. *A. OLIGANTHUM* *Karëlin et Kirilov* in Bull. Soc. Nat. Mosc. XIV (1841) 856.—*A. stenophyllum* Schrenk in Bull. Phys.-Math. Acad. Pétersb. III (1845) 210; Ledeb. Fl. Ross. IV (1852) 172; Kryl. Fl. Zap. Sib. III (1929) 613.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 4-6.

Bulbs attached, a few together, to a short rhizome, elongate-ovate, c. 1 cm. thick, with crustaceo-coricaeous, cinnamomeous or violet-cinnamomeous, disintegrating envelopes surrounding the base of the stem and there \pm parallel-fibrous. Scape 15-35 cm. high, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 1-2, semi-cylindric, fistular (?), canaliculate, 1-2 mm. wide, shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, persistent. Umbel fasciculate-hemispherical or spherical, \pm many-flowered, comparatively lax; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth rose-coloured with a darker nerve, 5-6 mm. long, oblong, acute. Filaments somewhat shorter than the perianth-segments, connate at the base and adnate to the perianth, entire, almost equal, subulate from a scarcely expanded base. Style somewhat exerted from the perianth. Capsule $\frac{2}{3}$ as long as it. VI-VII.

In salt-marshy meadows.—W. SIBERIA: 28 Irt.; C. ASIA: 41 Balkhash (N. part). Descr. from the region between the rivers Ayaguz and Donsyk. Type at Leningrad.

Section 4. *PHYLLODOLON* (*Salisbury*) *Prokhanov* in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot., Gen. i Selek.) XXIV (1930) 178.—*Phyllodolon* Salisbury, Gen. Pl. Fragm. (1866) 90.—Bulbs (in the wild species) attached to a rhizome, elongate, \pm crowded. Scape robust, hollow, clothed \pm high up in the aerial part with leaf-sheaths. Leaves fistular. Pedicels without bracteoles. Perianth campanulate; perianth-

segments with one nerve. Filaments entire. Capsule ovoid-trigonal, with scarcely perceptible foveae; seeds angular. [Spp. 86-88.]

86. *A. MICROBULBUM* Prokhanov in Bull. Appl. Bot., Leningrad, XXIV, 2 (1930) 180.

Bulbs attached, 1-3 together, to a short rhizome, ovoid-conical, 0.75-1.5 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape 20-25 cm. high, 0.75-1.5 cm. thick below the middle, gradually tapering upwards, clothed at the base with smooth leaf-sheaths. Leaves 2-3, cylindric, fistular, 5-7 mm. thick, gradually narrowed towards the apex, slightly shorter than or $\frac{1}{2}$ as long as the scape. Spathe shortly acuminate, equalling the umbel, persistent. Umbel spherical or almost spherical, many-flowered, dense, capitate; pedicels thick, unequal, the central ones somewhat longer, slightly shorter than or (the central ones) up to twice as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth yellowish, shining, 6-7 mm. long, acute, the inner ones oblong-elliptic, somewhat longer than the oblong-lanceolate outer ones. Filaments twice as long as the perianth-segments, connate at the base and adnate to the perianth, entire, almost equal, subulate from a triangular base. Style strongly exserted from the perianth. Capsule scarcely more than half as long as the perianth.

E. SIBERIA: 33 Dauria (known from 3 localities). According to Prokhanov it is a cultivated plant. Descr. from R. Shavka. Type at Leningrad.

87. *A. ALTAICUM* Pallas, Reise . . . II (1773) 737, t. R.—*A. fistulosum* Ledebour, Fl. Ross. IV (1852) 169; Turch. in Bull. Soc. Nat. Mosc. XXVII, 2 (1854) 120; Kryl. Fl. Zap. Sib. III (1929) 609.—Ic.: [Pallas, l. c.;] Prokhanov in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot.) XXIV, 2 (1930) 132.

Bulbs attached, 1—few together, to an oblique rhizome, oblong-ovoid, 2-4 cm. thick, with reddish-brown, thinly coriaceous, entire envelopes. Scape robust, 30-70-(100) cm. high, thick, 1-3 cm. thick below the middle, gradually tapering towards the apex, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 2-4, cylindric, fistular, 8-20 mm. wide, gradually narrowed towards the apex, short, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the scape. Spathe shortly acuminate, approximately equalling the umbel. Umbel spherical, many-flowered, dense, capitate; pedicels thick, almost equal, slightly shorter than or $1\frac{1}{2}$ times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth yellowish, shining, 6-8 mm. long, acuminate, the inner ones elliptic, the outer oblong-lanceolate, somewhat shorter than the inner. Filaments almost twice as long as the perianth, connate at the base and adnate to the perianth, entire, almost equal, subulate from a triangular base. Style exserted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VII-VIII.

On rocks and in stony places.—W. SIBERIA: 29 Alt.; E. SIBERIA: 32 Ang.-Sayan, 33 Dauria; C. ASIA: 42 Dzung.-Tarb. Gen. distr.: Dzung.-Kashg., Mongolia. Descr. from the Altai.

(88.) *A. FISTULOSUM* *Linné*, Sp. Pl. (1753) 301; Schmalh. Fl. II (1897) 489.—Ic.: Prokhanov in Bull. Appl. Bot., Leningrad (Tr. Prikl. Bot.) XXIV, 2 (1930) 133.

Bulbs oblong, sometimes almost undeveloped. Scape up to 1 m. high, thick, fistular, gradually inflated. Leaves fistular. Umbel spherical, many-flowered; pedicels slender, 2-3 times as long as the perianth. Perianth campanulate; perianth-segments yellowish, oblong, acute. Filaments 2-3 times as long as the perianth, entire.—Cultivated plant.

ECONOMIC IMPORTANCE. Abundantly cultivated in the Far East and in Siberia; to the west, beyond Bashkiria, it does not extend as a large-scale crop-plant. In the Far East, the Chinese use the whitened [? bleached] base of the stem ("Japanese leek"). In Europe, in more recent times, owing to the earlier development of the greenstuff, it has been employed in place of the green turnip onion ("winter onion").

Section 5. *CEPA* *Prokhanov* in Bull. Appl. Bot., Leningrad, XXIV (1930) 180.—Bulbs (in the wild species) attached to a rhizome, \pm crowded, often well developed, conical to ovoid. Scape robust, clothed \pm high up in the aerial part with leaf-sheaths. Leaves fistular. Pedicels with bracteoles. Perianth stellate; perianth-segments with one nerve. Filaments entire or the inner ones shortly bidentate at the base. Capsule depressed-spherical, provided with wide sacculae (nectaries) at the base. [Spp. 89-93.]

89. *A. GALANTHUM* *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 508; Ledeb. Fl. Ross. IV (1852) 169; Kryl. Fl. Zap. Sib. III (1929) 608.—*A. pseudo-cepa* Schrenk in Bull. Acad. Pétersb. X (1842) 355.—Ic.: Regel, Fl. Turk. (1876) t. 8, f. 6-8.

Bulbs attached, a few together, to a rhizome, conic-cylindric, 1.5-2.5 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape robust, 20-50 cm. high, solid, gradually narrowed to the apex, clothed at the base with smooth leaf-sheaths. Leaves 2-(3), cylindric, gradually narrowed to the apex, fistular, erect, 3-10 mm. wide, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the scape. Spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel. Umbel hemispherical or more often spherical, many-flowered, \pm dense; pedicels equal, 2-3 times as long as the perianth, with a few bracteoles at the base. Segments of the stellate perianth white with an inconspicuous nerve, 4-5 mm. long, equal, oblong, obtuse. Filaments scarcely longer than the perianth, adnate to the perianth at the base, subulate from expanded bases which are united into a ring, entire. Style shorter than the capsule. Capsule somewhat longer than the perianth. VII.

Rubbly and stony slopes.—W. SIBERIA: 28 Irt., 29 Alt.; C. ASIA: 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from R. Lepsa. Type at Leningrad.

NOTE. The plant from the Central Tien Shan requires further study.

90. *A. PSKEMENSE* *B. Fedchenko* in Bull. Jard. Bot. Pétersb. V (1905) 43.—Exs.: Herb. Fl. As. Med. no. 417, a et b.

Bulbs attached, a few together, to a rhizome, elongate-ovoid, 4-6 cm. thick, with red-brown, thinly coriaceous, entire envelopes. Scape robust, 40-80 cm. high, hollow, shallowly inflated below the middle, clothed at the base with smooth leaf-sheaths. Leaves 3, cylindric, narrowed to the apex, fistular, erect, 2-3 cm. thick, half as long as the scape. Spathe approximately equalling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with an inconspicuous nerve, *c.* 6 mm. long, equal, oblong, obtuse. Filaments somewhat longer than the perianth-segments, connate at the base and adnate to the perianth, slightly united above into a ring, the outer ones subulate, the inner subulate from a bidentate base, which is almost 3 times as broad as in the outer ones and³² distinctly broader than in the outer ones and distinctly broader than the base of the perianth-segments. Style shorter than the capsule. Capsule spherico-triquetrous. VIII.

In crevices of rocks and in stony places.—C. ASIA: 49 Tien Shan (Tashkent Ala Tau, Chatkal range). Endemic. Descr. from Pskem. Type at Leningrad.

91. A. VAVILOVI *M. Popov et Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 122.

Bulbs attached, 1-2 together, to a rhizome, ovoid-oblong, 2.5-4 cm. thick, with red-brown, coriaceous, entire envelopes. Scape robust, 70-90 cm. high, hollow, inflated $\frac{1}{4}$ - $\frac{1}{3}$ of the way up, clothed at the base with approximate smooth leaf-sheaths. Leaves 7-9, flattened, canaliculate, fistular, glaucous, almost biseriate, recurved, 7-15 mm. wide, several times shorter than the scape. Spathe with a short beak, approximately equaling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with a green nerve, about 4 mm. long, linear-oblong, obtuse, equal. Filaments equalling the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad as the outer at the base and somewhat broader than the perianth-segments, subulate from a broadly ovate, obtusely bidentate base; anthers greenish-yellow. Style shorter than the capsule. Capsule almost spherical, *c.* 4 mm. in diameter. VI.

In crevices of rocks and on stony slopes.—C. ASIA: 45 Mountain Turkm. Gen. distr.: N. Iran. Descr. from Kopet Dag: Hermab. Type at Tashkent.

92. A. OSCHANINI *O. Fedchenko* in Progress. Sadov. [Horticulture] i Ogorod. [Market-gardening] III (1906) 332, cum tab.—*A. Cepa* var. *sylvestre* Regel in A. H. P. X (1887) 314.—[Ic.: *O. Fedchenko*, l. c.] —Exs.: Herb. Fl. As. Med. no. 334.

Bulbs attached, 1-3 together, to a rhizome, ovoid, 2.5-4 cm. thick, with red-brown, coriaceous, entire envelopes. Scape robust, 45-100 cm. high, hollow, inflated below the middle, clothed at the base with \pm distant smooth leaf-sheaths. Leaves 4-5, cylindric, narrowed towards the apex,

³² [Evidently some error here. The words "ones and" should probably be omitted. —Translator's note.]

fistular, glaucescent, erect, 4-15-(40) mm. wide, $\frac{1}{3}$ as long as the scape. Spathe approximately equalling the umbel. Umbel spherical, dense, many-flowered; pedicels equal, 3-4 times as long as the perianth, with bracteoles at the base. Segments of the stellate perianth white with a green nerve, 4-5 mm. long, equal, linear-oblong or oblong-lanceolate, obtuse. Filaments $1\frac{1}{4}$ times as long as the perianth-segments, connate at the extreme base and adnate to the perianth, the outer ones subulate, the inner twice as broad as the outer at the base and somewhat wider than the perianth-segments, subulate from a broadly ovate, obtusely bidentate base. Style shorter than the capsule. Capsule spherico-triquetrous, c. 5 mm. in diameter. VI.

In crevices of rocks and on stony slopes.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (Mogol Tau). Endemic. Descr. without indication of native country (probably from the Alai range).³³

(93.) A. *CEPA* Linné, Sp. Pl. (1753) 300; Schmalh. Fl. II (1897) 489.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 236.

Bulb oblong or depressed-spherical, with yellow-brown, reddish or white envelopes. Scape up to 1 m. high, thick, inflated below the middle, fistular. Leaves fistular. Umbel spherical, dense, many-flowered; pedicels several times longer than the perianth. Perianth stellate, whitish-greenish, with oblong obtuse segments. Filaments longer than the perianth, the inner ones obtusely bidentate at the base. Cultivated plant.

ECONOMIC IMPORTANCE. Cultivated throughout the Union for the bulbs, which are stored up, and as a pot-herb. Large-scale cultures are found in the central zone of the European part of the USSR; there is also a considerable culture in Transcaucasia and Central Asia; it is rare in Siberia and the Far East, where it has only recently penetrated. In the north it is only grown for the greenstuff.

Sect. 6. **HAPLOSTEMON** [(Boissier) Halácsy, Consp. Fl. Graecae III (1904) 240, 250.—Sect. *Crommyum* subsect. *Haplostemon*] Boissier, Fl. Or. V (1882) 230, [249].—Bulb solitary, spherical, ovoid or oblong-ovoid, without a rhizome. Scape clothed with leaf-sheaths \pm high up in the aerial part. Perianth-segments with one nerve. Filaments entire or shortly bidentate. Seeds angular. [Spp. 94-142.]

94. A. **MARGARITAE** B. Fedchenko in Bull. Jard. Bot. Princ. XVIII, 1 (1918) 14.—A. *moschatum* auct. Fl. As. Med.—Exs.: Herb. Fl. As. Med. no. 61.

Bulb ovoid, 1-1.5 cm. thick, the outer envelopes brown or grey-brown, coriaceous, splitting, with prominent almost reticulate nerves. Scape 10-20 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 3-4, filiform, apparently semicylindric, canaliculate, smooth, equalling the scape. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, with a beak half as long as the base of the spathe, not becoming torn to the base, forming a small tube

³³ [A. *Cepa* var. *sylvestre* Regel (1887) was collected by Albert Regel in the mountains to the northwest of the Iskander Kul lake, south of the Zeravshan river.—W. T. S.]

surrounding the base of the umbel. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 2-4-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth almost white, with a strong, dirty-purple nerve, 5-6 mm. long, equal, lanceolate, acute. Filaments $\frac{2}{3}$ as long as the perianth, connate at the base and adnate to the perianth, subulate from a triangular base, the inner ones twice as broad; anthers yellow. Style not exerted from the perianth; ovary almost spherical, papillose [lit. "scabrid"]. Valves of the capsule almost circular, scarcely emarginate, c. 3 mm. long. VI-VII.

On outcrops of particoloured rocks.—C. ASIA: 41 Balkhash, 49 Tien Shan. Endemic. Descr. from the valley of the R. Chu: Uspenskoye. Type at Leningrad.

NOTE. It is very probable that, with more detailed study, this species, together with the four following, will have to be transferred to the section *Rhiziridium*.

95. *A. INAEQUALE* Janka in *Linnaea*, XXX (1860) 603.—*A. moschatum* auct., p. p.—Ic.: Fl. Yugo-Vost. I (1927) 367.

Bulb ovoid, 1-2 mm. thick; outer envelopes brown or grey-brown, almost coriaceous, splitting and \pm reticulate-fibrous, especially at the apex which embraces the base of the scape. Scape 10-25 cm. high, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4-(5), filiform, apparently semicylindric, canaliculate, smooth or more rarely scabrid, apparently shorter than the scape, withering towards flowering-time. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, with a beak equalling the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels usually very unequal, (2)-3-6-(10) times as long as the perianth, with a few bracteoles at the base. Segments of the campanulate perianth pale-rose with a purple nerve, 4-5-(7) mm. long, equal, oblong-lanceolate, obtuse. Filaments $\frac{1}{4}$ shorter than the perianth-segments, connate at the base and adnate to the perianth, the inner ones narrowly triangular, twice as broad as the triangular-subulate inner ones; anthers violet. Style not exerted from the perianth, usually c. 1.5 mm. long; ovary truncate-conical, scabrid. Valves of the capsule circular, scarcely emarginate, c. 3 mm. long. VI-VIII.

On steppe slopes, limestone, chalk, sand.—EUROPEAN PART: 13 Volga-Don (S. W. part), 16 Black Sea, 17 Crimea (Balaklava), 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc. (Stavropol), 21 Dag.³⁴ (?); C. ASIA: 40 Aral-Casp. Endemic. Descr. from Krasnoarmeisk.

NOTE. Typical *A. inaequale* occurs beyond the Volga; but to the west, over the south of the European part of the U S S R, a form is prevalent, transitional in character to *A. moschatum*, but coming nearest to *A. inaequale*. These forms require further detailed study.

96. *A. MOSCHATUM* Linné, *Sp. Pl.* (1762) 427; Ledeb. *Fl. Ross.* IV (1852) 172, p. p.; Boiss. *Fl. Or.* V (1882) 265; Schmalh. *Fl.* II (1897)

³⁴ Akhty, Becker — requires confirmation.

490, p. p.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1091.—Exs.: Fl. Hung. exs. no. 697.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes grey-brown, almost coriaceous, splitting, with reticulate nerves at the apex, which \pm surrounds the base of the stem, reticulate-fibrous or reticulate. Scape 10-25 cm. high, clothed for $1/3$ - $1/2$ with smooth leaf-sheaths. Leaves (4)-5-6, filiform, canaliculate, \pm convolute, ciliate-scabrid on the margin, approximately equalling the scape, lasting almost up to the time of fruiting. Spathe generally somewhat shorter than the umbel, with a beak generally exceeding the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate or more often hemispherical, \pm few-flowered; pedicels almost equal, equalling or 2-(3) times as long as the perianth, with a few bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, (5)-6-7 mm. long, almost equal, lanceolate, obtuse. Filaments almost $1/3$ shorter than the perianth-segments, connate at the base and adnate to the perianth, triangular-subulate, the inner ones $1\frac{1}{2}$ times as broad as the outer at the base; anthers violet. Style not exerted from the perianth, generally c. 3 mm. long; ovary pyriform, papillose [lit. "scabrid"]. Valves of the capsule c. 3 mm. long, almost circular, with a short narrowly emarginate apiculus at the apex. VII-VIII.

On rocks and dry slopes.—EUROPEAN PART: 12 Middle Dnepr (W. part), 17 Crimea; CAUCASUS: 20 Ciscauc., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: C. Eur., W. Medit., Balkans-Asia Min. Descr. from France and Spain.

97. *A. CALLIDICTYON* *C. A. Meyer ex Kunth*, Enum. IV (1843) 413; Ledeb. Fl. Ross. IV (1852) 173; Boiss. Fl. Or. V (1882) 266.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes rufescent, reticulate. Scape 10-20 cm. high, clothed for $1/3$ or almost $1/2$ with \pm hairy lower and smooth upper leaf-sheaths. Leaves 3-4, filiform, convolute, scabrid or smooth on the margin, shorter than the scape. Spathe half as long as the umbel, with a beak almost equalling the base of the spathe, torn down to the base. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, $1/5$ - $1/3$ as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth whitish with a dirty-green nerve, 6-7 mm. long, equal, oblong-lanceolate, the outer ones subacute, the inner obtuse. Filaments $1/4$ shorter than the perianth-segments, connate and adnate to the perianth for $1/4$, the inner ones triangular, twice as broad as the narrowly triangular outer ones; anthers yellow. Style not exerted from the perianth; ovary elongate-truncate-conical, smooth. VI.

In dry stony places.—Indicated for 23 E. and 24 S. Transcauc. I have seen no specimens thence. Gen. distr.: Asia Min., Iran. Descr. from N. Iran. Cotype at Leningrad.

98. *A. LACERUM* *Freyn* in Oesterr. Bot. Zeitschr. XLII (1892) 373 et herb. *A. laceratum* *Freyn* in Oesterr. Bot. Zeitschr. XLI (1891) 60, non Boiss. et Noë (1859).—*A. incisum* *Fomin* in Monit. Jard. Bot. Tiflis

14 (1909) 52—*A. araxanum* Fomin ex Grossheim, Fl. Kavk. I (1928) 211.—*A. fimbriatum* Shishkin in Izv. Tom. Gos. Un. [Inf. Tomsk State Univ. ?] 80 (1929) 432.

Bulb oblong-ovoid, c. 1 cm. thick; outer envelopes brownish, reticulate, sometimes prolonged and embracing the base of the stem. Scape 5-40 cm. high, slender, clothed half-way with \pm hairy leaf-sheaths. Leaves 3-5, semicylindric, canaliculate, apparently fistular, 0.5-1.5 mm. wide, scabrid-hirsute on the margin. Spathe somewhat shorter than, or half as long as, the umbel, with a beak half as long as the base of the spathe, not becoming torn to the base, forming a short tube surrounding the base of the umbel. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, $1\frac{1}{2}$ -3-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth pale-rose, almost white, in the herbarium sometimes yellowish, 6-7 mm. long, equal, the outer ones ovate or oblong-ovate, acute or subacute, with \pm reflexed apiculi, entire, the inner ones oblong-elliptic, obtuse, \pm deeply dissected along the margin in the upper part. Filaments $1\frac{1}{2}$ - $2\frac{2}{3}$ as long as the perianth-segments, connate at the base and adnate to the perianth, the inner ones triangular, twice as broad as the narrowly triangular outer ones. Style not exerted from the perianth. VII.

In rocky places.—CAUCASUS: 24 S. Transcauc. Gen. distr.: Asia Min., N. Iran. Descr. from Asia Minor: Amasia. Cotype at Leningrad.

99. *A. STAMINEUM* Boissier, Diagn. Pl. Or. II, 4 (1859) 119; Boiss. Fl. Or. V (1882) 256.—*A. kossoricum* var. *araraticum* Mishchenko ex Grossheim, Fl. Kavk. I (1928) 212, et in herb.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes greyish or blackish, papyraceous, almost without nerves; envelopes of the new [lit. "replacing"] bulb without noticeable nerves. Scape 20-30 cm. high, clothed for $(1/3)$ - $1/2$ - $2/3$ with smooth leaf-sheaths. Leaves 2-(4), semicylindric, c. 1 mm. wide, smooth, strait, longer than the scape.³⁵ Umbel capsuliferous, fasciculate or more often fasciculate-hemispherical, usually many-flowered; pedicels unequal, 2-5-(9) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a dirty-purple nerve, 4 mm. long, elliptic-oblong, obtuse with a rounded apex, the outer ones cymbiform, somewhat shorter than the outer. Filaments $1\frac{1}{4}$ or more rarely $1\frac{1}{2}$ times as long as the perianth-segments, more rarely³⁶ connate and adnate to the perianth for $1/5$, subulate, purple; anthers yellow. Ovary almost sessile, spherical, scabrid; style strongly exerted from the perianth. Valves of the capsule circular, shallowly emarginate, c. 3.5 mm. long. VI-VII.

Mountain steppes.—CAUCASUS: 24 S. Transcauc. Gen. distr.: E. Medit., Balkans.-Asia Min., Arm.-Kurd., Iran. Descr. from Asia Minor: Caria.

³⁵ "Umbel" in the original. —Translator's note.

³⁶ ["More rarely" should perhaps be omitted (? printer's error). —Translator's note.]

100. *A. KOSSORICUM* *Fomin* in *Monit. Jard. Bot. Tiflis* 14 (1909) 50.

Bulb ovoid, c. 1 cm. thick; outer envelopes blackish, torn into parallel fibres. Scape c. 20 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3, cylindric-filiform, smooth. Spathe somewhat shorter than the umbel. Umbel capsuliferous, few-flowered, fasciculate-hemispherical; pedicels unequal, 2-5 times as long as the perianth. Segments of the ovoid-campanulate perianth whitish-greenish with a small violet blotch, with a green nerve, 3-3.5 mm. long, elliptic-oblong, obtuse, with the apex rounded or provided with a small reflexed apiculus, the outer ones cymbiform, somewhat shorter than the inner. Filaments $1\frac{1}{2}$ -2 times as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, subulate, violet-coloured; anthers yellow. Ovary almost sessile, spherical, scabrid; style considerably exerted from the perianth. VI.

On dry stony slopes.—CAUCASUS: 24 S. Transcauc. Gen. distr.: Arm.-Kurd. Descr. from Olta, near the village of Kosor. Type at Tiflis.

NOTE. Cited by Grossheim (*Fl. Kavk. I*, 212) from various places in Transcaucasia, but I have not seen the material determined by him. It is described, in the original description, as having bulb-envelopes torn into parallel fibres; I have seen no bulbs from the type locality. All the green-flowered material of the *A. stamineum* (s. l.) group, with bulbs preserved, that I have at my disposal, has the outer bulb-envelopes without nerves or with feebly developed nerves.

A. stamineum, *A. kossoricum* and *A. pseudo-flavum*, together with other related *Allia* from Asia Minor, require further study; for their separation it will be essential to call in other characters besides the colour of the flowers, on which their separation is here chiefly based.

101. *A. PSEUDO-FLAVUM* *Vvedensky* in *Bull. Univ. As. Centr.* 19 (1934) 123.—*A. flavum* auct., quoad pl. Transcauc. et Pers., p. p.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes greyish or brownish, almost coriaceous, with distinct parallel nerves; envelopes of the new bulb with longitudinal nerves. Scape (10)-15-25 cm. high, clothed for $\frac{1}{3}$ or more rarely $\frac{1}{2}$ with scabrid, more rarely smooth leaf-sheaths. Leaves 4, filiform, c. 0.5 mm. wide, semicylindric, striate, scabrid or smooth on the margin, apparently shorter than the scape.³⁷ Spathe $1\frac{1}{2}$ -3 times as long as the umbel. Umbel capsuliferous, few-flowered, fasciculate or more rarely fasciculate-hemispherical; pedicels unequal, $1\frac{1}{2}$ -3-(5) times as long as the perianth, with bracteoles at the base. Segments of the ellipsoid-campanulate perianth yellow, more rarely with a rosy tinge, 4 mm. long, elliptic-oblong, obtuse, with the apex rounded or more often provided with a small reflexed apiculus, the outer ones cymbiform, scarcely shorter than the inner. Filaments $1\frac{1}{4}$ or more

³⁷ "Umbel" in the original. —Translator's note.

often $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, subulate, yellow; anthers yellow. Ovary almost sessile, spherical, papillose [lit. "scabrid"]; style considerably exserted from the perianth. Valves of the capsule circular, shallowly emarginate, 3.5 mm. long. VI-VII. (Tab. XII, fig. 1 a-c).

On dry slopes.—CAUCASUS: 23 E. & 24 S. Transcauc., 25 Talysh. Gen. distr.: N. Iran. Descr. from Nor Bayazet near the village of Subbotan. Type at Leningrad.

NOTE. Certain plants from E. Transcaucasia and Talysh have a rosy tinge to the perianth.

102. *A. PULCHELLUM* *G. Don*. Mon. (1827) 46, excl. syn. *A. paniculatum* et *A. Sequierianum*.—*A. flavum* var. *pulchellum* Ledebour Fl. Ross. IV (1852) 175, p. p.—*A. carinatum* var. *capsuliferum* Ledebour, l. c.—*A. flavum* var. *tauricum* Besser ex Reichenbach, Pl. Crit. VI (1828) f. 776.—*A. Paczoskianum* Tuzson in Bot. Közlem. XII (1913) 190, t. 5, f. 1.—*A. flavum* auct., quoad pl. Ross. Europ. et Cauc., p. p.—Ic.: Reichb. l. c., Tuzs. l. c.

Bulb ovoid, 0.75-1-(1.5) cm. thick; outer envelopes greyish or brownish, papyraceous, almost without nerves. Scape (20)-30-50 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 3-4, semi-cylindric, 0.5-1 mm. wide, smooth, striate, apparently usually shorter than the scape. Spathe 2-4-(5) times as long as the umbel. Umbel capsuliferous, fasciculate or fasciculate-hemispherical, generally many-flowered; pedicels very unequal, 2-10 times as long as the perianth. Segments of the ellipsoid-campanulate perianth yellowish with a \pm intense rosy tinge,³⁸ with a "bloom," matt [lustreless], (4)-5 mm. long, elliptic-oblong, obtuse, with a rounded apex, the outer ones cymbiform, somewhat shorter and broader than the inner. Filaments $1\frac{1}{2}$ -(2) times as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, subulate, generally violet; anthers bright-violet, pollen yellow. Style considerably exserted from the perianth; ovary on a distinct stipe, oblong, smooth. Valves of the capsule broadly obcordate, almost circular, 4-5 mm. long. VI-VII.

On dry slopes.—EUROPEAN PART: 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc., 22 W. and 23 E. Transcauc. Gen. distr.: Balkans-Asia Min. Descr. from Russia.

NOTE. The true *A. flavum* L. does not extend within the bounds of the U S S R, and all records of it, apart from certain Transcaucasian ones, refer to the present species. *A. flavum* is yellow with a complete absence of anthocyanin tints.

³⁸ [Vvedensky's description of the perianth of *A. pulchellum* as "yellowish with a more or less intense rosy tinge" seems to be taken from dried specimens. In a living state the perianth is a deep red-purple. Don cites Redouté, Liliac. V. t. 252 (1809), under the name "*A. paniculatum*," as representing his species. —W. T. S.]

103. *A. CARINATUM* *Linné*, Sp. Pl. (1753) 297; Ledeb. Fl. Ross. IV (1852) 174, excl. var. *capsuliferum*; Boiss. Fl. Or. V (1882) 255; Schmalh. Fl. II (1897) 488.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1057.—Exs.: Kerner, Fl. Hung. exs. no. 3483.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes blackish or brownish, almost papyraceous, with slender parallel nerves. Scape 25-45 cm. high, clothed half-way with scabrid or smooth leaf-sheaths. Leaves 3-(4), narrowly linear, 1-2 mm. wide, \pm convolute, striate, scabrid or smooth, apparently equalling the scape. Spathe 3 times as long as the umbel. Umbel with bulbils, fasciculate or more often fasciculate-spherical, lax, few-flowered; pedicels almost equal, 2-4 times as long as the perianth. Segments of the ovoid-campanulate perianth rose-coloured with a darker nerve, with a "bloom," matt, 5-6 mm. long, almost equal, elliptic-oblong, obtuse. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, subulate, purple; anthers bright-violet, pollen yellow. Style considerably exerted from the perianth; ovary oblong, on a short stipe, smooth. VI-VIII.

Cited for many localities in the western part of former European Russia, the majority of which do not come within the bounds of the U S S R, but in herbaria it is usually *A. oleraceum* L. which is represented under this name. I have not seen *A. carinatum* from within the bounds of the U S S R.

104. *A. OLERACEUM* *Linné*, Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 174; Schmalh. Fl. II (1897) 488; Kryl. Fl. Zap. Sib. III (1929) 631.—*A. scabrum* Gilib. Exerc. Phyt. II (1792) 469.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 238.

Bulb ovoid, c. 1 cm. thick; outer envelopes brownish or greyish, with slender parallel nerves. Scape 25-50 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth, more rarely scabrid leaf-sheaths. Leaves 3-4, narrowly linear, 1-2 mm. wide, \pm convolute, smooth or scabrid, shorter than the scape. Spathe 2-3 times as long as the umbel. Umbel with bulbils, fasciculate or fasciculate-hemispherical, lax, few-flowered, very rarely with bulbils alone without flowers; pedicels unequal, 2-4-(6) times as long as the perianth, generally flexuous. Segments of the narrowly-campanulate perianth greenish or more rarely rosy, 6-7 mm. long, equal, linear-oblong, obtuse, with the apex rounded, often provided with a very small apiculus. Filaments equalling the perianth-segments, connate and adnate to the perianth for $\frac{1}{5}$, subulate; anthers yellow. Style exerted from the perianth, almost $\frac{1}{2}$ shorter than the capsule. Valves of the capsule obcordate, c. 6 mm. long. VI-VII.

Over meadows, steppes, and slopes, and in thickets; sometimes as a weed.—EUROPEAN PART: 8 Ladoga-Ilmen, 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc. Gen. distr.: W. Eur. Descr. from Sweden and Germany.

105. *A. PANICULATUM* *Linné*, Syst. Nat. ed. 10, II (1759) 978; Boiss. Fl. Or. V (1882) 259, p. p.; Schmalh. Fl. II (1897) 489, excl. var.

rupestri.—*A. praescissum* Reichenbach, Pl. Crit. V. (1827) 17, f. 618.—*A. paniculatum* var. *legitimum* Ledebour, Fl. Ross. IV (1852) 176.—*A. fuscum* auct. fl. Ross.—Ic.: Reichb. l. c.—Exs.: H F R no. 535.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes greyish, papyraceous, with scarcely noticeable, slender, parallel nerves. Scape (20)-30-50 cm. high, clothed for $\frac{2}{3}$ with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-2 mm. wide, \pm convolute, striate, smooth or scabrid, apparently (at least the upper ones) longer than the scape. Spathe ($1\frac{1}{2}$)-2-4 times as long as the umbel. Umbel capsuliferous, fasciculate or more rarely fasciculate-hemispherical, lax, generally branched, \pm many-flowered; pedicels very unequal, 2-9 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, sometimes deep-rose, with a darker nerve, shining, more intensely coloured at the apex, 5-6 mm. long, equal, linear-oblong, obtuse, truncate. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth for $\frac{1}{4}$, subulate; anthers yellow. Style scarcely exerted from the perianth, $\frac{2}{5}$ as long as the capsule. Valves of the capsule obcordate, c. 5 mm. long. VII-VIII.

On steppes, in sandy places, on slopes.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 45 Mountain Turkm. Gen. distr.: S. Eur., Asia Min. (?). In the work of Linnaeus cited, the locality is not indicated; in later editions southern Europe is given.

NOTE. The Kopet Dag plant merits further study: in its dirty-rose, inconspicuous flowers it approaches *A. lenkoranicum*, but differs from it in the coarser envelopes of the bulbs and more slender leaves. Apart from that, it grows in entirely different conditions. The Kopet Dag plant is an inhabitant of dry mountain slopes.

106. *A. LENKORANICUM* *Mishchenko ex Grossheim*, Fl. Kavk. I (1928) 214.

Bulb ovoid, 1-2 cm. thick; outer envelopes greyish-brownish, thinly papyraceous. Scape 20-50 cm. high, clothed for $\frac{1}{2}$ - $\frac{2}{3}$ with smooth leaf-sheaths. Leaves 4-5, filiform, 1-2 mm. wide, convolute, apparently flat, withering before flowering-time. Spathe 6 times as long as the umbel. Umbel fasciculate, lax, comparatively few-flowered; pedicels unequal, 2-6 times as long as the inflorescence, with a few bracteoles at the base. Segments of the narrowly campanulate perianth dirty-lilac-rose, with a dirty-purple nerve, dull, 5-6 mm. long, linear-oblong, obtuse, with a rounded-truncate apex, sometimes provided with a little apiculus. Filaments scarcely shorter than or equalling the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{5}$, subulate; anthers yellow. Style exerted from the perianth, half as long as the capsule. Valves of the capsule broadly obovate, c. 4 mm. long. VIII.

On slopes in the forest zone.—CAUCASUS: 25 Talysh. Endemic. Descr. from Lenkoran.

107. *A. KARSIANUM* *Fomin* in *Monit. Jard. Bot. Tiflis*, 14 (1909) 51.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes greyish, papyraceous, almost without noticeable nerves. Scape 20-40 cm. high, clothed for $2/3$ - $3/4$ with smooth leaf-sheaths. Leaves 3-4, narrowly linear, 1-1.5 mm. wide, \pm convolute, striate, smooth or scabrid, longer than the scape. Spathe 2-3 times as long as the umbel. Umbel fasciculate or more often fasciculate-hemispherical, mostly dense and many-flowered; pedicels unequal, equalling or 2-5 times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth pale-rose, almost white, with a purple nerve, shining, (6)-7-8 mm. long, linear-oblong, obtuse with a rounded apex. Filaments $1/4$ shorter than the perianth-segments, connate, and adnate to the perianth, for $1/5$, subulate; anthers yellow (?). Style not exerted from the perianth, $1/2$ as long as the capsule. Valves of the capsule obcordate, c. 5 mm. long. VII.

On stony slopes and rocks.—CAUCASUS: 23 E. and 24 S. Transcauc. Endemic. Descr. from Olta: Kyrkh Kilis-Khas Kei. Type at Tiflis.

NOTE. A species very close to *A. Kunthianum* Vved. and requiring verification from fresh material. In herbaria it is commonly found under the name *A. paniculatum*, a species which, however, does not occur in Transcaucasia. From the latter it is distinguished very much better than from *A. Kunthianum*.

108. *A. KUNTHIANUM* *Vvedensky*, nom. nov.—*A. lepidum* Kunth, *Enum. IV* (1843) 408, p. p., quoad pl. Hohenack., non Ledeb. (1833); Boiss. *Fl. Or. V* (1882) 263.—*A. paniculatum* var. *macilentum* Ledebour, *Fl. Ross. IV* (1852) 176, p. p.

Bulb (usually paired) ovoid, 0.75-1 cm. thick; outer envelopes blackish, papyraceous, without noticeable nerves. Scape (5)-10-30 cm. high, clothed for $1/2$ - $2/3$ with smooth leaf-sheaths. Leaves 2-(4), apparently semicylindric, c. 1 mm. wide, striate, smooth, or scabrid on the margin, longer than the scape. Spathe $1\frac{1}{2}$ -2 times as long as the umbel. Umbel capsuliferous, fasciculate-hemispherical, \pm few-flowered; pedicels almost equal, somewhat shorter than or 2-(3) times as long as the perianth, with a few bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, mostly deep-rose, with a purple nerve, shining, (6)-7-8 mm. long, equal, linear-oblong, subobtuse with \pm reflexed apiculi. Filaments slightly or $1/4$ shorter than the perianth-segments, connate, and adnate to the perianth, for $1/5$, subulate; anthers yellow. Style not exerted from the perianth, $1/2$ as long as the capsule. Valves of the capsule obcordate, c. 5 mm. long. VII-IX. (Tab. XII, fig. 2 a, b).

On high-mountain meadows and rocks.—CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Endemic. Descr. from the neighbourhood of Shushi.

NOTE. To this species, apparently, belongs the plant cited by Albov (*Tr. Tifl. Bot. Sada*, I (1895) 240) as *A. subquinqueflorum* Boiss. I have seen neither Albov's specimens nor any other examples of *A.*

subquinqueflorum, a species which, according to Albov, deserves further study. According to Boissier, *A. subquinqueflorum* has smaller (5 mm.) whitish flowers.

109. *A. RUPESTRE* Steven in Mém. Soc. Nat. Mosc. III (1812) 260.—*A. paniculatum* var. *macilentum* Ledebour, Fl. Ross. IV (1852) 176, p. p.—*A. paniculatum* var. *pallens* Boissier, Fl. Or. V (1882) 260, p. p.—*A. paniculatum* var. *rupestre* Regel in A. H. P. III, 2 (1875) 192; Schmalh. Fl. II (1897) 489.—*A. charaulicum* Fomin in Monit. Jard. Bot. Tiflis, 14 (1909) 54 (?).—Ic.: Reichb. Pl. Crit. V (1827), f. 616, 617.—Exs.: Pl. Or. exs. no. 57.

Bulb ovoid, c. 1 cm. thick; outer envelopes papyraceous, with very slender parallel nerves; bulblets whitish, with slender parallel nerves, small, generally absent. Scape 25-40 cm. high, clothed halfway with scabrid, very rarely smooth leaf-sheaths. Leaves (2)-3, filiform-linear, 0.5-1 mm. wide, \pm convolute, striate, generally scabrid, considerably shorter than the scape. Umbel capsuliferous, fasciculate or fasciculate-hemispherical, more rarely almost spherical, usually few-flowered; pedicels almost equal, slightly shorter than or $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth pale-rose, almost white, with a purple nerve, not shining, 5-6 mm. long, almost equal, oblong-elliptic, obtuse, the apex rounded or more often provided with a very short apiculus. Filaments equalling or scarcely longer than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{5}$, subulate; anthers violet. Style exerted from the perianth, $\frac{1}{5}$ as long as the capsule. Valves of the capsule obcordate, almost circular, 5mm. long. VIII-X.

On stony and sandy slopes and rocks.—EUROPEAN PART: 17 Crimea; CAUCASUS: 21 Dag., 22 W. & 23 E. Transcauc. Gen. distr.: Asia Min. Descr. from Mtskheta.

NOTE. *A. charaulicum* (loc. class. Artvin: Kharaul) is described as having filaments $1\frac{1}{2}$ times as long as the perianth-segments and pedicels 4 times exceeding the perianth. An authentic specimen, preserved at Leningrad, shows filaments equalling the perianth-segments and pedicels equalling the perianth or only $1\frac{1}{2}$ times as long. The question needs further investigation.

110. *A. CONVALLARIOIDES* Grossheim in Grossheim et Shishkin, Pl. Orient. Exs. (1924) no. 107.—*A. pallens* Vvedensky in Fl. Turkm. I (1932) 263.—Exs.: Pl. Orient. l. c.

Bulb ovoid, c. 1 cm. thick; outer envelopes greyish, papyraceous, almost without noticeable nerves. Bulblets yellowish, with very slender parallel nerves, generally absent. Scape 40-60 cm. high, clothed for almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 4-5, narrowly linear, 1-1.5 mm. wide, canaliculate, striate, smooth, apparently shorter than the scape. Spathe $1\frac{1}{2}$ -2 (?) times as long as the umbel. Umbel capsuliferous, fasciculate-ovoid or fasciculate-spherical, dense, many-flowered; pedicels unequal, 2-5 times longer than the perianth, with bracteoles at the base. Segments of the campanulate perianth white, 4-5 mm. long,

broadly linear-oblong, obtuse, truncate, the inner ones somewhat longer; filaments scarcely longer than the perianth-segments, connate, and adnate to the perianth, for $1/5$, subulate; anthers yellow. Style exserted from the perianth, $1/4$ as long as the capsule. Capsule somewhat longer than the perianth, with almost circular scarcely emarginate valves. VI-VII.

In slightly saline localities.—CAUCASUS: 23 E. & 24 S. Transcauc.; C. ASIA: 45 Mountain Turkm. Endemic (?). Descr. from Erivan: Dzhevish. Type at Baku.

111. *A. KIRINDICUM* Bornmüller in Bot. Centralbl. XXXIII, 2 (1915) 209.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes papyraceous, greyish, with slender, distant, parallel nerves; bulblets none. Scape 15-25 cm. high, clothed with (1)-2-(5) sheaths (the lower ones scabrid, the upper often smooth), of which the uppermost more often exceeds the base of the umbel and simulates a spathe, more rarely reaching only to the middle of the scape. Leaves filiform, canaliculate, scabrid, not exceeding the umbel, the uppermost one abbreviated. Spathe persistent, several times shorter than the umbel, very shortly acuminate. Umbel fasciculate or fasciculate-hemispherical, few-flowered, lax; pedicels very slender, almost equal, 3-5 times as long as the perianth, with bracteoles at the base. Segments of the tubular-campanulate perianth white or very light-rose with a strong dirty-purple nerve, 4-5 mm. long, almost equal, oblong-lanceolate, subobtuse, the inner ones somewhat broader. Filaments slightly or up to $1/3$ shorter than the perianth-segments, connate, and adnate to the perianth, for $1/3$, entire, triangular-subulate, almost equal. Style not exserted from the perianth. Capsule (immature) $1/3$ shorter than the perianth. VIII.

C. ASIA: 45 Mountain Turkm. Found once on consolidated screes on Mt. Dushak. Gen. distr.: Iran. Descr. from Nehavend.

112.³⁹ *A. FIBROSUM* Regel in A. H. P. X (1887) 322, t. 7, f. 2.—*A. Korolkowi* var. *albidum* O. Kuntze in A. H. P. X (1887) 243.—*A. leucosphaerum* Aitchison et Baker in Trans. Linn. Soc. Ser. 2, Bot. III (1888) 117.—Ic.: Regel, l. c.—Exs.: Herb. Fl. As. Med. no. 177.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes brown, almost coriaceous, splitting, with reticulate venation; bulblets numerous, large, with reticulate nerves, yellowish. Scape (more often 2 from one bulb) (15)-25-60 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-6, semicylindric, 0.5-2 mm. wide, canaliculate, fistular, smooth

³⁹ The group of *A. rubellum* s. l. (112-120) represents a very intricate, polymorphic, eastern Mediterranean, xerophilous complex, still far from adequately studied. Herewith is presented an attempt to distinguish within it elementary units, many of which were at one time described as independent species, but later came to be regarded as synonyms of *A. rubellum* M. B. These units are not sharply defined, and show transitions in all the characters of which it was possible to make use in the herbarium.

or more rarely scabrid, shorter than the scape. Spathe with a long beak usually exceeding the base of the spathe, coming away entire, early caducous. Umbel capsuliferous, hemispherical or almost spherical, more rarely fasciculate, dense, many-flowered; pedicels almost equal, $(1\frac{1}{2})$ -3-5 times as long as the perianth, without bracts. Perianth broadly campanulate, umbilicate at the base, segments white, rose or deep-rose, with a strong green or purple nerve, 4-5-(6) mm. long, equal, elliptic or oblong-elliptic, obtuse with a short, small apiculous, the inner ones somewhat broader than the outer. Filaments $\frac{1}{2}$ - $\frac{3}{4}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$ - $\frac{1}{3}$, entire, the inner ones triangular, twice as broad as the narrowly triangular outer ones. Style not exerted from the perianth. Capsule somewhat shorter than the perianth. IV-V.

In sandy deserts and in foothills on particoloured rocks.—C. ASIA: 44 Kara Kum, 45 Mountain Turkm. Gen. distr.: N. Afghanistan. Descr. from Chikishlyar. Type at Leningrad.

113. *A. SYNTAMANTHUM* C. Koch in Linnaea, XXII (1849) 238.—*A. rubellum* var. *parviflorum* Ledebour Fl. Ross. IV (1853) 171, p. p.; Boiss. Fl. Or. V (1882) 253, p. p.

Bulb ovoid, c. 1 cm. thick; outer envelopes brown, coriaceous, splitting, with strong almost reticulate nerves; bulblets few, large, winged, elongate, yellowish, with slender nerves. Scape 15-30 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth approximate leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, apparently fistular, smooth, c. 1 mm. wide, apparently shorter than the scape. Spathe coming away entire, early caducous, \pm rose-coloured. Umbel capsuliferous, hemispherical or almost spherical, dense, \pm few-flowered; pedicels almost equal, slightly or more often 2-(3) times longer than the perianth, without bracteoles. Segments of the broadly campanulate, umbilicate-based perianth deep-rose with a purple nerve, 3-4 mm. long, linear-oblong, obtuse, the outer ones up to $1\frac{1}{2}$ times broader and scarcely shorter than the inner. Filaments somewhat shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, entire, the outer ones narrowly triangular, the inner triangular, $1\frac{1}{2}$ times as broad as the outer and equalling the perianth-segments at the base. Style not exerted from the perianth. Capsule scarcely shorter than the perianth. V-VI.

On stony slopes.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from the Erivan district. Type at Berlin.

114. *A. RUBELLUM* Marschall-Bieberstein, Fl. Taur.-Cauc. I (1808) 264; III (1819) 260.—*A. rubellum* var. *parviflorum* Ledebour, Fl. Ross. IV (1852) 171, p. p.; Boiss. Fl. Or. V (1882) 253, p. p.

Bulb ovoid, c. 1 cm. thick; outer envelopes brown, coriaceous, splitting, with strong almost reticulate nerves; bulblets few, large, winged, yellowish, with slender nerves. Scape (sometimes 2 from one bulb) 15-40 cm. high, clothed at the base or for $\frac{1}{4}$ with approximate smooth leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, smooth, or more rarely scabrid on the margin, 1-2 mm. wide, usually shorter

than the scape. Spathe somewhat shorter than the umbel, with a beak somewhat shorter than the base of the spathe, coming away entire, early caducous. Umbel capsuliferous, hemispherical or almost spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles. Segments of the broadly campanulate, umbilicate-based perianth rose with a purple nerve, 3-4-(5) mm. long, oblong or more often oblong-lanceolate, attenuate, acute or subobtuse, the outer ones somewhat broader and shorter than the inner. Filaments $\frac{1}{4}$ or $\frac{1}{3}$ shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, entire, the outer ones narrowly triangular, the inner triangular, $1\frac{1}{2}$ times as broad as the outer and equalling the perianth-segments at the base. Style not exerted from the perianth. Capsule somewhat shorter than the perianth. V.

On dry slopes.—CAUCASUS: 23 E. Transcauc., 25 Talysh (?). Gen. distr.: N. Iran (?). Descr. from Georgia.

NOTE. Typical *A. rubellum* s.s. is found in the western part of E. Transcaucasia and does not reach Gandzha. Here, and also farther to the south-east along the right bank of the Kura, *A. rubellum* is not always distinguishable from *A. albanum*. I therefore refer the Talysh and certain North Persian material to the present species with a query.

115. *A. ALBANUM* Grossheim, Fl. Kavk. I (1928) 211.—*A. rubellum* var. *grandiflorum* Ledebour, Fl. Ross. IV (1852) 171; Boiss. Fl. Or. V (1882) 253, p. p.—*A. rubellum* Schmalhausen, Fl. II (1897) 490.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 7-9.

Bulb ovoid, c. 1 cm. thick; outer envelopes coriaceous, brown, splitting, with strong almost reticulate nerves; bulblets few, generally small, yellowish, very rarely brownish, sometimes winged, with slender nerves. Scape (often 2 from one bulb) 10-30 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-5-(6), semicylindric, canaliculate, fistular, smooth, or more rarely scabrid on the margin, 1-2-(3) mm. wide, usually shorter than the scape. Spathe somewhat shorter than the umbel, with a beak equalling the base of the spathe, coming away entire, early caducous, sometimes rose-coloured. Umbel capsuliferous, hemispherical or more rarely spherical, dense, many-flowered; pedicels almost equal, 2-3-(4) times longer than the inflorescence, without bracteoles. Segments of the campanulate, umbilicate-based perianth rose with a purple nerve, (4)-5-6 mm. long, oblong-lanceolate, attenuate, acute or subacute, the outer ones somewhat broader and shorter than the inner. Filaments $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, entire, the outer ones narrowly triangular, the inner triangular, $1\frac{1}{2}$ times as broad as the outer and equalling the perianth-segments at the base. Style not exerted from the perianth. Capsule ($\frac{1}{2}$)- $\frac{2}{3}$ as long as the perianth. V-VI.

On dry slopes, in semi-desert and on dry mountain steppes.—EUROPEAN PART: 19 Lower Volga (Bogdo); CAUCASUS: 21 Dag., 23 E. Transcauc. (to the east of Gandzha); C. ASIA: 40 Aral-Casp.

(Manghyshlak, Kara Bugaz), 45 Mountain Turkm. Gen. distr.: N. Persia. Descr. from various localities in E. Transcaucasia.

NOTE. The plants from Apsheron deserve further study, since they are usually stocky, with leaves exceeding the scape, while at the same time approaching *A. scabrellum* in certain characters (e. g. nervation of bulblets, colour of flowers). The reference of the Kopet Dag mountain-steppe plants to this species also requires confirmation.

Among the Kopet Dag representatives of the *A. rubellum* (s. l.) group, an onion with small white flowers, obtained by many collectors from Gaudan, still remains obscure.

116. *A. SCABRELLUM* *Boissier et Buhse* in Nouv. Mém. Soc. Nat. Mosc. XXII (1860) 215; Boiss. Fl. Or. V (1882) 251.—*A. rubellum* ssp. *scabrellum* Vvedensky in Herb. Fl. As. Med. (1926) no. 180.—Exs.: HFR no. 1190, sub *A. Tschulpias*; Herb. Fl. As. Med., l. c.

Bulb ovoid, (1)-2 cm. thick; outer envelopes \pm coriaceous, brown, splitting, with reticulate nerves, sometimes bast-like; bulblets generally numerous, small, yellowish, unwinged, often with distinct cells between the nerves. Scape 25-50 cm. high, clothed for $\frac{1}{3}$ with smooth, or more rarely scabrid, \pm distant leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, scabrid on the nerves, more rarely smooth, 2-3 mm. wide, shorter than the scape. Spathe somewhat shorter than the umbel, with a beak approximately equalling the base of the spathe, coming away entire, falling early, often rose-coloured. Umbel capsuliferous, fasciculate-hemispherical, more rarely almost spherical, dense, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, without bracts. Segments of the narrowly campanulate, umbilicate-based perianth generally pale-rose with an inconspicuous purple nerve, shining in the herbarium, (5)-6-7 mm. long, almost equal, lanceolate or oblong-lanceolate, usually strongly attenuate, acute or subacute, the outer ones somewhat broader than the inner. Filaments $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$ - $\frac{1}{3}$, entire, the outer ones narrowly triangular, the inner generally broadly triangular, twice as broad as the outer and usually slightly broader than the base of the perianth-segments. Style not exerted from the perianth. Capsule half as long as the perianth. V-VI. (Tab. XIII, fig. 1 a-c).

Generally as a weed in oases.—C. ASIA: 45 Mountain Turkm., 47 Syr Dar., 48 Pam.-Al. Gen. distr.: Iran. Descr. from Yezd. Type at Leningrad.

117. *A. JACQUEMONTII* *Kunth*, Enum. IV (1843) 399.⁴⁰

Bulb ovoid, 0.5-1 cm. thick; outer envelopes greyish, almost papyraceous, with almost parallel nerves; bulblets few, whitish, unwinged, with

⁴⁰ [*A. Jacquemontii* Kunth (1843), which Regel regarded as synonymous with *A. rubellum* M. Bieb., should not be confused with *A. Jacquemonti* Regel in A. H. P. III 2 (1875) 162, which is a plant with elongate-cylindric bulbs, reticulate-fibrous bulb envelopes and slightly exerted stamens of which the inner filaments are slightly toothed at base. This last plant is so closely allied to *A. Eduardi* Stearn (*A. Fischeri* Regel, non Besser) that no new name is proposed for it at present.—W. T. S.]

slender nerves. Scape 15-35 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth \pm distant leaf-sheaths. Leaves 2-(3), semicylindric, canaliculate, fistular, smooth or more rarely scabrid, 1-2 mm. wide, shorter than the scape. Spathe coming away entire, early caducous. Umbel capsuliferous, hemispherical, dense, \pm many-flowered; pedicels almost equal, equalling or $1\frac{1}{2}$ times (to twice) as long as the perianth, without bracteoles. Segments of the campanulate, umbilicate-based perianth rose-coloured, with a strong dirty-purple nerve, 5-(6) mm. long, almost equal, somewhat attenuate, oblong-lanceolate, acute, the outer ones somewhat broader than the inner. Filaments almost $\frac{1}{3}$ shorter than the perianth, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones narrowly triangular, the inner broadly triangular, twice as broad as the outer and somewhat broader than the perianth-segments at the base. [Ovary . . . ? Style . . . ? Capsule . . . ?] V.

Stony slopes in the lower mountain zone.—C. ASIA: 48 Pam.-Al. (Shugnan). Gen. distr.: N. W. India. Descr. from India. Type at Paris.

NOTE. I refer the Shugnan material to this species with some doubt, as I have had no Indian plants for comparison.

118. A. ANISOTEPALUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 123.

Bulb ovoid, 0.5-0.75-(1) cm. thick; outer envelopes grey-brown or brown, coriaceous, splitting, with indistinct almost reticulate nerves; bulblets few, unwinged, small, whitish, with slender nerves. Scape 10-25-(40) cm. high, covered for $\frac{1}{3}$ with smooth \pm distant leaf-sheaths. Leaves 2-3-(4), filiform, apparently semicylindric, canaliculate, smooth, or more rarely scabrid on the margin, 0.5-1.5 mm. wide, usually shorter than the scape. Spathe usually $\frac{1}{3}$ shorter than the umbel, with a short beak $\frac{1}{3}$ - $\frac{1}{2}$ as long as the base of the spathe, sometimes rose-coloured, generally persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical or hemispherical, dense, \pm many-flowered; pedicels almost equal, equalling or $1\frac{1}{2}$ -2 times as long as the perianth, without bracteoles. Segments of the campanulate, intruse-based perianth rose-coloured with a dirty-purple nerve, unequal, the outer ones (4)-5-(6) mm. long, very attenuate, acute, oblong or oblong-lanceolate, more rarely lanceolate, $1\frac{1}{4}$ or more often $1\frac{1}{2}$ times as long as the inner, which are acute, oblong or oblong-elliptic, and up to $1\frac{1}{2}$ times broader than they. Filaments $\frac{1}{6}$ - $\frac{1}{5}$ as long as the outer perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$ - $\frac{1}{2}$, the outer ones narrowly triangular, the inner broadly triangular, 2-(3) times as broad as the outer and approximately equalling the perianth-segments at the base. Style not exerted from the perianth. Capsule half as long as the perianth.^{40a} (Tab. XIII, fig. 2, a-c).

Rubbly and earthly slopes in the montane steppe zone.—C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan (Fergana range). Endemic. Descr. from the Fergana range: Arslanbob. Type at Leningrad.

^{40a} [Flowering period omitted. —Note by translator.]

119. *A. MINUTUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 124.

Bulb ovoid, 0.5-0.75 cm. thick; outer envelopes almost coriaceous, black-brown, \pm splitting, with almost reticulate nerves; bulblets few, un-winged, small, whitish, with slender nerves. Scape 10-20 cm. high, slender, clothed for $\frac{1}{4}$ with smooth \pm distant leaf-sheaths. Leaves 2-3, filiform, c. 0.5 mm. wide, apparently semicylindric, canaliculate, smooth, shorter than the scape. Spathe $\frac{1}{3}$ shorter than the umbel, very shortly acuminate, persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical, or hemispherical, dense, \pm few-flowered; pedicels almost equal, equalling or $1\frac{1}{2}$ times (to twice) as long as the perianth, without bracteoles. Segments of the broadly campanulate, intruse-based perianth white, with a dirty-green nerve, 3-4-(5) mm. long, oblong, very rarely oblong-lanceolate, usually shortly acuminate, acute, the outer ones generally somewhat longer and broader than the inner. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones triangular, the inner broadly triangular, almost twice as broad as the outer and equalling the perianth-segments at the base. Style not exserted from the perianth. Capsule $\frac{1}{3}$ shorter than the latter. V-VII.

Rubbly and particoloured (? always) mountain slopes.—C. ASIA: 48 Pam.-Al. (Fergana range). Endemic. Descr. from the Kok Su valley. Type at Leningrad.

120. *A. PARVULUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 124.

Bulb ovoid, 0.5-0.75 cm. thick; outer envelopes almost coriaceous, black-brown, \pm splitting, with almost reticulate nerves; bulblets few, un-winged, small, whitish, with slender nerves. Scape (sometimes 2 from one bulb) 10-20 cm. high, slender, clothed for $\frac{1}{4}$ with smooth \pm distant leaf-sheaths. Leaves 3-4, filiform, c. 0.5 mm. wide, apparently semicylindric, canaliculate, smooth, shorter than the scape. Spathe $\frac{1}{2}$ -($\frac{2}{3}$) as long as the umbel, with a short beak $\frac{1}{4}$ - $\frac{1}{3}$ as long as the base of the spathe, generally persistent, torn down to the base. Umbel capsuliferous, fasciculate-hemispherical or hemispherical, dense, \pm many-flowered; pedicels almost equal, ($1\frac{1}{2}$)-2-3 times as long as the perianth, without bracteoles. Segments of the campanulate, intruse-based perianth white with a dirty-green nerve, 4-(5) mm. long, equal, oblong-lanceolate or lanceolate, very attenuate, acute, often with reflexed apiculi. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones narrowly triangular, the inner broadly triangular, twice as broad as the outer and somewhat broader (at the base) than the perianth-segments. Style not exserted from the perianth. Capsule $\frac{1}{2}$ as long as the latter. V.

Rubbly (apparently particoloured) slopes of the lower mountain zone.—C. ASIA: 49 Tien Shan (Alexander range, Trans-Ilian Ala Tau). Endemic. Descr. from Aulië Ata: Tek Turmas. Type at Leningrad.

121. *A. GRIFFITHIANUM* Boissier, Diagn. Pl. II, 4 (1859) 117.—*A. Tschulpias* Regel in A. H. P. III, 2 (1875) 107.—*A. Kuschakewiczii* Regel, l. c. (1875) 117.—*A. tenue* Regel, l. c. (1875) 206, non G. Don.—*A. Bahri* Regel in A. H. P. X (1887) 326, t. 1, f. 2.—Ic.: Regel, Fl. Turk. (1876) t. 10, f. 10-12; ibid. t. 11, f. 12-13.—Exs.: Herb. Fl. As. Med. no. 66, sub *A. Tschulpias*.

Bulb ovoid, 1-2 cm. thick; outer envelopes almost coriaceous, splitting, with reticulate nerves; bulblets few, large, yellowish, with reticulate venation. Scape 10-30-(50) cm. high, clothed at the base or for $\frac{1}{3}$ with smooth or more rarely slightly scabrid leaf-sheaths. Leaves 2-3, semi-cylindric, canaliculate, fistular, 1-2 mm. wide, usually scabrid on the margin, generally shorter than the scape. Spathe somewhat shorter than the umbel, with a short beak, coming away entire, quickly caducous; umbel capsuliferous or very rarely with bulbils, hemispherical, dense, \pm many-flowered; pedicels \pm unequal, shorter than, or usually equalling or up to twice as long as, the perianth, without bracteoles. Segments of the campanulate perianth light-flesh-pink with a darker nerve, oblong-lanceolate or lanceolate, subobtuse or obtuse, unequal, the outer ones 7-8 mm. long, $\frac{1}{4}$ - $\frac{1}{3}$ longer and somewhat broader than the inner, which are provided at the base with a fovea. Filaments $\frac{1}{3}$ as long as the outer perianth-segments, connate, and adnate to the perianth, for $\frac{1}{2}$ - $\frac{2}{3}$, entire, the inner triangular, twice as broad as the narrowly triangular outer ones. Style not exerted from the perianth. Capsule $\frac{1}{2}$ as long as the latter. IV-V.

Soft soils of foothill deserts and of the lower mountain zone.—C. ASIA: 47 Syr Dar., 48 Pam.-Al. (does not reach the Fergana valley). Gen. distr.: Afghanistan. Descr. from the Kabul region. Type at Geneva.

122. *A. OPHIOPHYLLUM* Vvedensky in Herb. Fl. As. Med. (1928) no. 336.—Exs.: l. c.

Bulb ovoid, c. 1 cm. thick; outer envelopes cinnamomeous, almost coriaceous, with obscurely reticulate nerves, \pm torn into laciniae at the apex and base; bulblets few, straw-yellow with parallel nerves. Scape 15-40 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, cylindric, fistular, 1-1.5 mm. wide, glaucous, spirally, often almost helicoidally, coiled, smooth or slightly scabrid. Spathe persistent, $\frac{1}{3}$ shorter than the umbel, with a very short beak. Umbel capsuliferous, fasciculate or hemispherical, generally few-flowered, \pm dense; pedicels almost equal, (1)-1 $\frac{1}{2}$ -2 times as long as the perianth, without bracteoles. Segments of the campanulate perianth light-violet with a darker nerve, shining when withering, bluish, (6)-7 mm. long, obtuse, the inner ones linear-oblong, somewhat longer than the lanceolate outer ones. Filaments equalling or scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, violet, the outer ones triangular-subulate, the inner narrowly triangular, somewhat broader than the outer. Style scarcely exerted from the perianth. Capsule half as long as the latter. IV-V.

Outcrops of particoloured rocks.—C. ASIA : 46 Amu Dar., 47 Pam.-Al. Endemic. Descr. from Khaudak Tau. Type at Tashkent.

123. *A. INOPS* *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 91.

Bulb conspicuous, c. 1 cm. thick; outer envelopes cinnamomeous or greyish, almost papyraceous, without nerves. Scape 8-17 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2-3, apparently semi-cylindric, filiform, c. 0.5 mm. wide, smooth, somewhat shorter than or equalling the scape. Spathe early caducous, thinly membranous. Umbel capsuliferous, fasciculate, later almost spherical, few-flowered, lax; pedicels equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rosecoloured with a purple nerve, 6-7 mm. long, equal, lanceolate, acute or subacute. Filaments connate, and adnate to the perianth, for $\frac{1}{4}$, the inner subulate from a triangular base, $\frac{1}{4}$ shorter than the perianth-segments, $1\frac{1}{2}$ times as long and 2-3 times as broad as the subulate outer ones; anthers yellow. Style not exerted from the perianth, $\frac{1}{3}$ as long as the capsule, the latter half as long as the perianth, with almost circular, scarcely emarginate valves. V.

On outcrops of saline [saliferous, halophorous] rocks.—C. ASIA : 49 Tien Shan. Endemic. Descr. from the neighborhood of Aulië Ata: Dair Mulla. Type at Leningrad.

124. *A. LASIOPHYLLUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 125.

Bulb ovoid, 5-8 mm. thick; outer envelopes grey, papyraceous, without noticeable nerves, prolonged, surrounding the base of the scape; bulblets none. Scape (very rarely, 2 from one bulb) 10-20 cm. high, clothed for $\frac{1}{2}$ with densely short-hairy leaf-sheaths. Leaves 2-4, filiform, 0.5-1 mm. wide, apparently flat, canaliculate, glabrous or \pm densely pubescent, shorter than the scape. Spathe scarcely more than $\frac{1}{3}$ as long as the umbel, with a beak less than half as long as the base of the spathe, persistent. Umbel capsuliferous, fasciculate, \pm few-flowered; pedicels almost equal, equalling or $1\frac{1}{2}$ times as long as the perianth, with bracteoles at the base. Segments of the narrowly campanulate perianth rosecoloured with a darker nerve, 6-7 mm. long, equal, linear-lanceolate, acute, the outer ones scarcely broader. Filaments $\frac{1}{4}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, the inner triangular-subulate, $1\frac{1}{2}$ times as broad at the base as the almost subulate outer ones. Style not exerted from the perianth. Capsule (almost ripe) scarcely more than half as long as the perianth. VI.

C. ASIA : 49 Tien Shan (Tekes). Endemic. Type at Leningrad.

125. *A. DELICATULUM* *Sievers ex Roemer et Schultes*, Syst. VII (1830) 1133; Ledeb. Fl. Ross. IV (1852) 171; Schmalh. Fl. II (1897) 490; Kryl. Fl. Zap. Sib. III (1929) 610.—*A. Willdenowii* Kunth, Enum. IV (1843) 453; Ledeb. Fl. Ross. IV (1852) 190.—*A. viridulum* auct.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 7-9.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes grey or almost black, papyraceous, without noticeable nerves; bulblets solitary, almost smooth, commonly absent. Scape 15-45 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 2-3, filiform, 0.5-1.5 mm. wide, apparently semi-cylindric, canaliculate, smooth or very rarely scabrid, shorter than the scape. Spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, with a beak equalling or 3 times exceeding the base of the spathe, persistent. Umbel capsuliferous, fasciculate or more often fasciculate-hemispherical, more rarely almost spherical, dense, many-flowered; pedicels almost equal, slightly or commonly 2-3-(4) times longer than the perianth, with numerous rather large bracteoles at the base. Segments of the campanulate perianth whitish or rose with a strong violet-purple nerve, (3)-4-6 mm. long, equal, subobtuse or subacute, lanceolate or oblong, the inner ones somewhat broader. Filaments equalling or $\frac{1}{4}$ shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{5}$, entire, triangular-subulate, the inner ones $1\frac{1}{2}$ times as broad as the outer at the base. Style scarcely exerted from the perianth. Capsule somewhat shorter than the perianth. VI-VII.

In salt-marshes, in wormwood [*Artemisia*] deserts, more rarely on chalk formations.—EUROPEAN PART: 14 Transvolga (S. part), 19 Lower Volga; W. SIBERIA: 27 Upper Tob., 28 Irt.; C. ASIA: 40 Aral-Casp., 41 Balkhash. Gen. distr.: Dzung.-Kashg. Descr. from the "Krigiz desert."

126. *A. GLOMERATUM* Prokhanov in Bull. Jard. Bot. Princ. URSS, XXIX (1930) 560, fig. II.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey, papyraceous, with slender parallel nerves, prolonged, surrounding the base of the scape, bulblets none. Scape often \pm flexuous, 10-20 cm. high, clothed for $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 2-3, narrowly linear, 0.5-1.5 mm. wide, apparently flat, canaliculate, smooth, or scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe persistent, almost equalling the umbel, with a beak slightly shorter than or half as long as the base of the spathe. Umbel capsuliferous, hemispherical, dense, few-flowered; pedicels almost equal, slightly shorter than or equalling the perianth, with narrow bracteoles at the base. Segments of the campanulate perianth rosy-violet with a darker nerve, (4)-5 mm. long, lanceolate, acute, the outer ones scarcely broader. Filaments equalling or scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, entire, subulate, almost equal; anthers violet. Style scarcely exerted from the perianth. Capsule $\frac{2}{3}$ as long as the perianth. VII-VIII.

Argillaceous and stony slopes.—C. ASIA: 49 Tien Shan (C. Tien Shan). Gen. distr.: Dzung.-Kashg. Descr. from Kashgaria: Kok Muinak Pass. Type at Leningrad.

127. *A. PALLASI* Murray, Comment. Goetting. VI (1775) 32, t. 3; Ledeb. Fl. Ross. IV (1852) 170; Kryl. Fl. Zap. Sib. III (1929) 612.—*A. tenue* G. Don, Mon. (1827) 34.—*A. lepidum* Ledebour, Ic. Pl. Fl. Ross. IV (1833) 17.—*A. caricifolium* Karelin et Kirilov in Bull. Soc. Nat. Mosc.

XIV (1841) 854.—*A. semiretschenskianum* Regel in A. H. P. V (1878) 630.—*A. Alberti* Regel in A. H. P. V (1878) 632.—Ic.: Ledeb. Ic. Pl. Fl. Ross. IV (1833), t. 355.—Exs.: H. F. A. M. no. 337.

Bulb ovoid, 1-2 cm. thick; outer envelopes grey, papyraceous, without nerves, or almost coriaceous, brownish, with parallel nerves; bulblets none. Scape (sometimes 2 from one bulb) (10)-20-65 cm. high, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves (2)-3-4, filiform or narrowly linear, 0.5-1.5-(2.5) mm. wide, smooth, or scabrid on the margin, shorter than the scape. Spathe persistent, slightly shorter than or $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, shortly acuminate. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, rather lax; pedicels almost equal, ($1\frac{1}{2}$)-2-3-(4) times as long as the perianth, with a few bracteoles or more often without them. Segments of the broadly campanulate, sometimes almost stellate perianth rose-coloured with a purple nerve, shining, 3-4 mm. long, equal, lanceolate or oblong-lanceolate, obtuse or subacute. Filaments equalling or up to $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base, the inner ones $1\frac{1}{2}$ times as broad at the base, sometimes obtusely bidentate at the base. Style slightly exserted from the perianth. Capsule equalling or $\frac{2}{3}$ as long as the latter. V-VI.

In salt-marshes, on carbonate [? of calcium] slopes, on outcrops of parti-coloured rocks and on stony and rubbly slopes in the alpine and subalpine zones.—W. SIBERIA: 28 Irt., 29 Alt.; C. Asia: 40 Aral-Casp. (Mai Tyube), 41 Balkhash, 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from Siberia.

NOTE. The mountain plants have the outer bulb-envelopes papyraceous, without nerves; in plants from the plains they are generally almost coriaceous, with distinct parallel nerves. More detailed investigation of this phenomenon is needed.

128. *A. MACROSTEMON* *Bunge* [Enum. Pl. China Bor. (1833) 65, reimpr. in] Mém. Sav. Étr. Acad. Pétersb. II (1835) 139⁴¹; Kom. et Alis. Opred. Rast. Dalnevost. Kraya, I (1931) 365.—*A. uratense* Franchet in Nouv. Arch. Mus. Hist. Nat. VII (1884) 114.

Bulb almost spherical, 1-2 cm. thick; outer envelopes blackish, papyraceous, without noticeable nerves; bulblets none. Scape (40)-60-90 cm. high, covered for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, linear, 2-3 mm. wide, not fistular, canaliculate, smooth, considerably shorter than the scape. Spathe persistent, half as long as the umbel, with a beak half as long as or almost equalling the base of the spathe. Umbel with bulbils (sometimes almost without flowers), more rarely without bulbils (var. *uratense* Airy-Shaw in Notes Bot. Gard. Edinb. XVI (1931) 136), hemispherical or spherical, \pm many-flowered, dense; pedicels almost equal, (2)-3-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the broadly campanulate, almost hemispherical

⁴¹ [The separate edition of Bunge's paper was published in March 1833 before its appearance in the Mémoires of the Petrograd Academy in 1835; cf. Stearn in Journ. of Bot. LXXIX (1941) 63. —W. T. S.]

perianth deep rose with a darker nerve, (4)-5 mm. long, almost equal, oblong or oblong-lanceolate, subacute. Filaments $\frac{1}{4}$ longer than the perianth-segments, connate and adnate to the perianth at the base, entire, gradually becoming subulate from an expanded base, the inner ones $1\frac{1}{2}$ times as broad as the outer. Style exserted from the perianth. VI-VII.

In meadows and plough-lands.—FAR EAST: 38 Ussuri. Gen. distr.: Japan-China. Descr. from Pekin.

129. *A. CAERULEUM* Pallas, Reise. . . II (1773) 727, t. R; Ledeb. Fl. Ross. IV (1852) 170; Kryl. Fl. Zap. Sib. III (1929) 611.—*A. coerulescens* G. Don, Mon. (1827) 34.—*A. azureum* Ledebour, Fl. Alt. II (1830) 13.—*A. viviparum* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XIV (1841) 852; Kryl. Fl. Zap. Sib. III (1929) 611.—Ic.: Ledeb. Ic. Pl. Fl. Ross. II (1830) t. 136.—Exs.: Herb. Fl. As. Med. no. 335.

Bulb almost spherical, 1-2 cm. thick; outer envelopes papyraceous, grey, without noticeable nerves; bulblets gray-violet or violet, without nerves, usually absent. Scape (rarely 2 from one bulb) 25-85 cm. high, clothed for $\frac{1}{3}$ with smooth or scabrid leaf-sheaths. Leaves (2)-3-4, triquetrous, canaliculate, (1)-2-4 mm. wide, smooth or more rarely scabrid, shorter than the scape; spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, acuminate, persistent. Umbel capsuliferous or with bulbils (var. *bulbilliferum* Ledebour, Fl. Ross. IV (1853) 170), hemispherical or spherical, dense, many-flowered; pedicels equal, 2-5 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth sky-blue with a darker nerve, 4-5 mm. long, equal, subobtuse, the outer ones oblong-lanceolate, the inner lanceolate. Filaments equaling or slightly longer than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base, the inner ones twice as broad as the outer at the base, sometimes bidentate below the middle. Style exserted from the perianth. Capsule slightly shorter than the perianth. VI-VII.

In salt-marshes and salt-marshy meadows, and in mountains in the steppe zone.—EUROPEAN PART: 19 Lower Volga; W. SIBERIA: 27 Upper Tob. (Naurzum), 28 Irt. (S. part), 29 Alt.; C. ASIA: 40 Aral—Casp., 41 Balkhash, 42 Dzung.-Tarb., 49 Tien Shan (except the Tashkent Ala Tau), 48 Pam.-Al. (Alai range, Mogian). Gen. distr.: Dzung.-Kashg. Descr. from the neighborhood of Semipalatinsk: Berezovka.

NOTE. When growing together, *A. caeruleum* and *A. caesium* sometimes form hybrids with each other; such are known, for example, from Kulan Utmes (Irt.).

130. *A. CAESIUM* Schrenk in Bull. Phys.-Math. Acad. Pétersb. II (1844) 113; Ledeb. Fl. Ross. IV (1852) 166.—*A. urceolatum* Regel in A. H. P. II (1873) 406.—*A. Renardi* Regel in A. H. P. VI (1880) 521.—Ic.: Regel, Fl. Turk. (1876) t. 9, f. 10-12.—Exs.: Herb. Fl. As. Med. no. 56; HFR no. 2789.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, grey, without noticeable nerves; bulblets greyish-brownish or violet, with indistinct longitudinal nerves. Scape 15-65 cm. high, clothed for $\frac{1}{4}$ or

sometimes $\frac{1}{2}$ with scabrid, more rarely smooth, leaf-sheaths. Leaves 2-3, semicylindric, canaliculate, 1-3 mm. wide, fistular (? always), scabrid, more rarely almost smooth, slightly longer or slightly shorter than the stem. Spathe $\frac{1}{2}$ as long as the umbel, acuminate, persistent. Umbel usually capsuliferous, more rarely with bulbils, very rarely with bulbils only, without flowers, generally hemispherical or spherical, many-flowered, dense; pedicels equal, 2-3-(5) times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth dark azure blue with a darker nerve, more rarely white, 4-6 mm. long, equal, oblong or oblong-lanceolate, subobtuse, the inner ones somewhat broader. Filaments slightly or $\frac{1}{4}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate from a triangular base, the inner twice as broad at the base, widened for $\frac{2}{3}$, obtusely bidentate. Style slightly exserted from the perianth. Capsule $\frac{2}{3}$ as long as the latter. V-VI.

In the steppe zone in salt-marshes, in semi-desert; in the southern part in foothills and mountains up to 2000 m.—W. SIBERIA: 28 Irt. (S. part); C. ASIA: 40 Aral-Casp., 41 Balkhash, 42 Dzung.-Tarb., 47 Syr Dar., 48 Pam.-Al. (Alai and Turkestan ranges), 49 Tien Shan. Gen. distr.: Dzung.-Kashg. Descr. from Karaganda. Type at Leningrad.

NOTE. The plants from the Alai range, and part of those from the Fergana range, have, judging from the herbarium, generally darker flowers with a distinct violet tinge; they are narrower and longer, generally 6 mm. long. Such plants were noted by Drobov (in herb. Acad. et Univ. As. Med.) as *A. Litvinovii*, and were evidently proposed for publication in the Herb. Fl. Ross. under this name. These plants from Fergana, and also the white-flowered plants sometimes occurring in great quantities in one locality (e.g. the Chu-Ili Mts., Chimgan), require further study. *A. Renardi* was described by Regel as having white flowers.

131. *A. ELEGANS* *Drobov* in Sched. ad H F R (1917) no. 2790.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes coriaceous, greyish or brownish, splitting, without noticeable nerves; bulblets few, brownish or violet, smooth. Scape 10-20 cm. high, clothed $\frac{1}{4}$ - $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2, filiform, 0.5-1 mm. wide, canaliculate, smooth, slightly shorter than or equalling the scape. Spathe very small, several times shorter than the umbel, acuminate, persistent. Umbel capsuliferous, fasciculate or more often hemispherical or almost spherical, \pm many-flowered, lax; pedicels almost equal, (3)-4-6 times as long as the perianth, the outer ones ascending, with bracteoles at the base. Segments of the campanulate perianth in the living state white, in the herbarium light-violet with a darker nerve, 5-6 mm. long, almost equal, lanceolate, subobtuse. Filaments $\frac{2}{3}$ as long as the perianth, connate, and adnate to the perianth, for $\frac{1}{4}$, entire, triangular-subulate, the inner twice as broad as the outer at the base. Style not exserted from the perianth. Capsule $\frac{1}{2}$ as long as the perianth. V-VI. (Tab. XIII, fig. 4 a, b).

Clayey-rubbly slopes.—C. ASIA: 48 Pam.-Al. (Alai range, Sary Tau). Endemic. Descr. from the Alai range: R. Shakhimardan, village of Pulgan. Type at Leningrad.

132. *A. KOPETDAGENSE* *Vvedensky* in *Bull. Univ. As. Centr.* 19 (1934) 125.

Bulb ovoid, 0.5-0.75 cm. [sphalm. "mm."] wide; outer envelopes papyraceous, grey, with scarcely noticeable parallel nerves; bulblets none. Scape 5-12 cm. high, clothed for $\frac{1}{2}$ - $\frac{3}{4}$ with smooth leaf-sheaths. Leaves 3, filiform, semicylindric, canaliculate, smooth, considerably exceeding the umbel. Spathe persistent, $\frac{1}{3}$ as long as the umbel, without a beak. Umbel capsuliferous, hemispherical or more rarely almost spherical, lax, few-flowered; pedicels almost equal, equalling or $1\frac{1}{2}$ times as long as the perianth, without bracteoles. Segments of the campanulate perianth rose-coloured with a purple nerve, 6-7 mm. long, narrowly lanceolate, acute, equal. Filaments $\frac{1}{3}$ shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones triangular-subulate, the inner triangular, almost 3 times as broad as the outer and $1\frac{1}{2}$ times as broad as the perianth-segments at the base. Style not exerted from the perianth. Capsule scarcely more than $\frac{1}{2}$ as long as the perianth, with broadly obcordate valves. VI.

Rubbly slopes.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Prokhaladnoye. Type at Leningrad.

133. *A. OREOPHILOIDES* *Regel* in *A. H. P.* III, 2 (1875) 114.—*Ic.*: *Regel*, *Fl. Turk.* (1876) t. 11, f. 4-6.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes papyraceous, grey, with scarcely noticeable parallel nerves; bulblets none. Scape 3-10 cm. high, smooth or \pm (sometimes very strongly) scabrid, clothed for $\frac{1}{4}$ - $\frac{1}{2}$ with smooth or \pm scabrid leaf-sheaths. Leaves 2, filiform, c. 0.75 mm. wide, apparently semicylindric, canaliculate, \pm scabrid, or almost smooth, longer than the scape. Spathe persistent acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel. Umbel capsuliferous, hemispherical or almost spherical, \pm few-flowered, generally dense; pedicels almost equal, 2-3 times as long as the inflorescence, with a few bracteoles at the base. Segments of the broadly campanulate perianth pale-rose with a strong purple nerve, 4-5 mm. long, equal, acute, the inner ones oblong-ovate, somewhat broader than the oblong outer ones. Filaments $\frac{1}{3}$ shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, the outer ones triangular-subulate, the inner twice as broad at the base, widened almost to the apex, bidentate. Style not exerted from the perianth. Capsule scarcely more than $\frac{1}{2}$ as long as the perianth. VII-VIII.

On moraines and rocks in the alpine zone.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (valleys of the rivers Susamyr, W. Karakol, Talas). Endemic. Descr. from the Shchurovsky glacier. Type at Leningrad.

NOTE. The Tien Shan plants are more attenuate and generally more strongly pubescent, but there is too little material to enable one to settle the problem of their taxonomic status.

134. *A. SCHOENOPRASOIDES* Regel in A. H. P. V (1878) 630.—*A. sairamense* Regel in A. H. P. VI (1880) 520.—*A. Kesselringi* Regel in A. H. P. VIII (1883) 272.— *Ic. :* Regel in A. H. P. X (1887) t. 1, f. 3— *Exs. :* Herb. Fl. As. Med. no. 340.

Bulb broadly ovoid, almost spherical, 1-1.5 cm. [sphalm. "mm."] thick; outer envelopes papyraceous, blackish, very thin, without nerves; bulblets none. Scape (10)-15-40 cm. high, clothed for $\frac{1}{3}$, or more often for $\frac{1}{2}$ or slightly more, with smooth leaf-sheaths; upper sheaths inflated in the upper part. Leaves 2-(3), narrowly linear, (1)-2-3 mm. wide, flat, canaliculate, smooth, or more rarely scabrid on the margin, usually somewhat shorter than the scape. Spathe slightly shorter than or equaling the umbel, shortly acuminate, early caducous. Umbel capsuliferous, hemispherical or more often spherical, \pm many-flowered, dense, sometimes almost capitate; pedicels almost equal, equalling or $\frac{1}{2}$ as long as the perianth, later $1\frac{1}{2}$ times as long, without or with a few bracteoles. Segments of the narrowly campanulate perianth rose-coloured, with an inconspicuous darker nerve, shining, (4)-6-7-(8) mm. long, almost equal, oblong-lanceolate, subacute or subobtuse, entire, the outer ones somewhat broader than the inner. Filaments $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, the outer ones subulate from a narrowly triangular base, the inner twice as broad as the outer, widened for $\frac{2}{3}$ of their height, \pm bidentate. Style not exerted from the perianth. Capsule $\frac{1}{2}$ as long as the perianth. VII-VIII.

Stony slopes in the alpine and subalpine zones.—C. ASIA: 42 Dzung.-Tarb., 49 Tien Shan (principally Central), Pam.-Al. (Alai range, Bakhan). Gen. distr.: Dzung.-Kashg. Descr. from the neighbourhood of Alma Ata.

135. *A. KUJUKENSE* Vvedensky in Trans. Sci. Soc. Turk. I (1923) 124.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes papyraceous, grey, somewhat prolonged at the apex; bulblets few, whitish, foveolate, sometimes absent. Scape 7-20 cm. high, clothed with strongly scabrid leaf-sheaths (and buried in the ground) for half its length. Leaves solitary, cylindric, 1-2 mm. wide, fistular, strongly scabrid, usually considerably exceeding the umbel. Spathe persistent, $\frac{1}{2}$ as long as the umbel, without a beak. Umbel capsuliferous, fasciculate-hemispherical or more rarely almost spherical, lax, \pm few-flowered; pedicels almost equal, equalling or up to twice as long as the perianth. Segments of the narrowly campanulate perianth purple, with a darker nerve, 8-10 mm. long, equal, acute, the outer ones lanceolate, the inner oblong-lanceolate, denticulate at the apex. Filaments $\frac{1}{2}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{3}$, entire, the outer ones triangular-subulate, the inner triangular, 3 times as broad as the outer; style not exerted from the perianth. Capsule scarcely more than $\frac{1}{3}$ as long as the perianth. V-VI. (Tab. XIII, fig. 3 a-c).

Rubbly and clayey slopes of the lower mountain zone.—C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from the Kuyuk Mts. Type at Tashkent.

136. *A. EREMOPRASUM Vvedensky* in Not. Syst. Herb. Horti. Bot. Petrop. V (1924) 92.—Exs.: Herb. Fl. As. Med. no. 176.

Bulb ovoid, c. 1 cm. thick; outer envelopes papyraceous, greyish, \pm foveolate and wrinkled; bulblets foveolate. Scape (10)-15-25 cm. high, clothed half-way with smooth leaf-sheaths; leaves 2, filiform, apparently semicylindric, canaliculate, smooth, withering towards flowering time. Spathe persistent, $1/10$ - $1/5$ as long as the umbel, acuminate. Umbel capsuliferous, fasciculate, few-flowered, lax; pedicels unequal, 3-7 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth dirty-rose with a dirty-purple nerve, (5)-6-7 mm. long, acute, the outer ones lanceolate, entire, the inner oblong-lanceolate, denticulate, with a small sacculus at the base, $1\frac{1}{2}$ times as broad as and scarcely longer than the outer. Filaments $1/3$ shorter than the perianth-segments, connate, and adnate to the perianth, half-way, entire, the outer ones narrowly triangular, the inner broadly triangular, almost 3 times as broad as the outer. Style not exerted from the perianth. Capsule scarcely more than $1/2$ as long as the perianth. V-VI.

Stony slopes of the lower mountain zone.—C. ASIA: 48 Pam. Al. (known from one spot: the Zera Bulak heights). Endemic. Descr. from the Zera Bulak heights. Type at Tashkent.

137. *A. POPOVII Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 124.—Exs.: Herb. Fl. As. Med. no. 63.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes generally light-brown, coriaceous, with longitudinal projecting crests, splitting at the apex and base; bulblets light-brownish, cristate-foveolate. Scape (15)-20-40 cm. high, slender, clothed half-way or slightly higher with smooth leaf-sheaths. Leaves 3-4, filiform, canaliculate, fistular, c. 0.5 mm. wide, smooth, or scabrid on the margin, approximately equalling the scape. Spathe $1/4$ - $1/3$ as long as the umbel, acuminate, generally persistent. Umbel capsuliferous, spherical or almost spherical, \pm few-flowered, lax; pedicels equal, 3-6 times as long as the perianth, with numerous bracteoles at the base; segments of the almost spherical perianth whitish with a dirty-purple nerve, smooth, c. 3 mm. long, almost equal, oblong, acute, the outer ones cymbiform, somewhat narrower than the inner. Filaments somewhat longer than the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exerted from the perianth. Capsule somewhat shorter than the perianth. VI.

Outcrops of particoloured rocks, rubbly slopes, "takyr".—C. ASIA: 47 Syr Dar. (Dzhety Sai, Kurkat, S. W. foothills of Mogol Tau), 48 Pam.-Al. (between Kabadian and Dzheli Kul). Endemic. Descr. from Dzhety Sai. Type at Tashkent.

NOTE. Apart from those enumerated, there are also the following localities: 47 Syr-Dar. (Mt. Mansur Ata, between the stations of Chanak and Montai Tash) and 48 Pam.-Al. Zera Bulak heights). Fresh material is needed from these spots, since the existing material is incomplete and does not permit of certainty regarding the correctness of the identification.

138. *A. CONFRAGOSUM* *Vvedensky* in Sched. ad Herb. Fl. As. Med. (1935) no. 619.—Exs.: Herb. Fl. As. Med. no. 341, sub *A. scrobiculato*.

Bulb ovoid, 1-1.5 cm. thick, the outer envelopes coriaceous, greyish-brownish or blackish, foveolate, splitting at the base; bulblets black-brown, tuberculate-foveolate. Scape 15-30 cm. high, slender, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4, filiform, c. 0.5 mm. wide, semicylindric, canaliculate, smooth, or scabrid on the margin, equalling or more often somewhat shorter than the scape. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, long-acuminate, generally persistent. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, dense; pedicels almost equal, 2-4 times as long as the perianth, with numerous bracteoles at the base. Segments of the almost spherical perianth cinnamomeous, in the herbarium with a violet tinge, especially at the tips of the perianth-segments, c. 3 mm. long, equal, oblong-ovate, acute, the outer ones cymbiform, scabrid. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate at the base and adnate to the perianth, entire, equal, subulate. Style exserted from the perianth. Capsule (almost ripe) somewhat shorter than the perianth. V-VI.

On rocks and on rubbly slopes.—C. ASIA: 49 Tien Shan. Known from a few points on the Mogol Tau Mts. Endemic. Descr. from the mountain of Spa. Type at Tashkent.

139. *A. SCROBICULATUM* *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 123.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes blackish or brownish, coriaceous, foveolate, splitting at the base; bulblets apparently few, brown, foveolate. Scape 10-20 cm. high, generally thickish, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4, filiform, c. 0.5 mm. wide, semicylindric, canaliculate, smooth, apparently equalling the scape. Spathe $\frac{1}{4}$ as long as the umbel, long-acuminate, generally persistent. Umbel capsuliferous, hemispherical or spherical, \pm few-flowered, rather lax; pedicels equal, 4-6 times as long as the perianth, the outer ones often ascending, with numerous bracteoles at the base. Segments of the almost spherical perianth rose-violet with a dirty-purple nerve, 3-3.5 mm. long, almost equal, smooth, subacute, the outer ones cymbiform, oblong, somewhat narrower than the oblong-ovate inner ones. Filaments $1\frac{1}{2}$ times as broad as the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exserted from the perianth. Capsule almost $\frac{1}{3}$ shorter than the perianth. V.

Outcrops of particoloured rocks, rubbly slopes, salt-marshes.—C. ASIA: Tien-Shan (Trans-Kara Tau plain, Chu-Ili Mts.). Endemic. Descr. from Lake Ak Kul. Type at Tashkent.

140. *A. TRANSVESTIENS* *Vvedensky* in Herb. Fl. As. Med. (1935) no. 619.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes light-brownish, coriaceous, slightly foveolate-rugulose, sometimes smooth, the young (sterile) bulbs more foveolate, with longitudinal crests; bulblets numerous, light-brown, tuberculate-foveolate. Scape 30-60 cm. high, slender,

clothed for $1/5$ - $1/4$ with smooth leaf-sheaths. Leaves 3, semicylindric, canaliculate, fistular, 1.5-2 mm. wide, smooth, apparently considerably shorter than the scape, withering towards flowering-time. Spathe $1/3$ shorter than the umbel, acuminate, persistent. Umbel capsuliferous, spherical, dense, many-flowered; pedicels equal, 2-3 times as long as the perianth, with numerous bracteoles at the base. Segments of the almost spherical perianth pale-lilac with a darker nerve, c. 3 mm. long, smooth, obtuse, the outer ones cymbiform, elliptic-oblong, the inner oblong-ovate. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, entire, equal, subulate. Style exserted from the perianth. VI. (Tab. XII, fig. 3 a-d).

Outcrops of particoloured rocks.—C. ASIA: 45 Mountain Turkm. Known from two places in the neighbourhood of the Kara Kal Mts. Endemic. Type at Tashkent.

141. *A. SABULOSUM* *Steven ex Bunge* in Goebel, *Reise . . .* II (1838) 311; Ledeb. *Fl. Ross.* IV (1852) 170; Boiss. *Fl. Or.* V (1882) 251, p. p., exclus. specim. Bunge.; Schmalh. *Fl.* II (1897) 489.—Ic.: Regel, *Fl. Turk.* (1876) t. 9, f. 1-3.

Bulb oblong-ovoid, $1\frac{1}{2}$ -2 cm. thick; outer envelopes coriaceous, light-brown, with immersed, distant, parallel nerves, owing to which the envelopes appear corrugated [lit. "goffered"], often lacerate along the nerves; bulblets light-brown, irregularly tuberculate-foveolate. Scape 20-60 cm. high, thick, as it were shallowly [lit. "slantingly"] inflated, clothed for $1/4$ with smooth leaf-sheaths. Leaves 3-4, semicylindric, canaliculate, fistular, 1-2 mm. wide, smooth or more rarely scabrid, shorter than the scape. Spathe almost equalling the umbel, acuminate, caducous. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, \pm dense; pedicels equal, 3-5 times as long as the perianth, with numerous bracteoles at the base. Segments of the hemispherical perianth greenish or whitish, with a green nerve in fruit, transversely wrinkled, c. 3 mm. long, equal, elliptic, the outer ones scabrid, cymbiform, obtuse, the inner ones emarginate. Filaments somewhat longer than the perianth-segments, connate, and adnate to the perianth, at the extreme base, entire, equal, linear-subulate. Style exserted from the perianth. Capsule c. 3 mm. long, with circular scarcely emarginate valves. V-VI.

Sandy deserts.—EUROPEAN PART: 19 Lower Volga; C. ASIA: 40 Aral-Casp., 41 Balkhash, 43 Kyzyl-Kum, 45 Mountain Turkm. (Kushkin region). Gen. Distr.: Dzung.-Kashg. Descr. from the northern shore of the Caspian Sea.

NOTE. *A. sabulosum* varies somewhat in the bulb-envelopes:—sometimes strongly fibrous envelopes occur, but the great bulk of the herbarium material lacks envelopes altogether, hence it is impossible to make any definite statement about such examples.

142. *A. TURKESTANICUM* *Regel* in A. H. P. III, 2 (1875) 197.—*A. nothum* Vvedensky in *Opred. Rast. Okr. Tashk.* I (1923) 66.—Exs.: *Herb. Fl. As. Med.* no. 343.—Ic.: Regel, *Fl. Turk.* (1876) t. 15, f. 6-8.

Bulb almost spherical, 1.5-3 cm. thick; outer envelopes papyraceous, grey, without noticeable nerves; bulblets none. Scape (40)-70-100 cm. high, clothed for $\frac{1}{4}$ with smooth or very rarely scabrid leaf-sheaths. Leaves 4-6, linear, gradually narrowed from the base to the apex, 2-10 mm. wide, flat, scabrid on the margin, considerably shorter than the scape, very quickly withering. Spathe persistent, equalling the umbel, with a long beak equalling the base of the spathe. Umbel capsuliferous, spherical, dense, many-flowered; pedicels almost equal, (2)-3-4 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth rose-coloured, with an inconspicuous darker nerve, *c.* 3 mm. long, almost equal, obtuse, the outer ones ovate, cymbiform, the inner elliptic, narrowed towards the base. Filaments slightly longer than, or up to $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate from a triangular base, the inner subulate from a broadly ovate obtusely bidentate base, twice as broad as the outer at the base and slightly broader than the perianth-segments. Style strongly exserted from the perianth. VI-VII.

Principally on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp. (lower course of R. Sary Su), 41 Balkhash (Balkhash), 49 Tien Shan (sporadically in the foothills from Alm Ata to Mogol Tau), 45 Mountain Turkm. (Sulyuklyu). Endemic. Descr. from Mogol Tau. Type at Leningrad.

Sect. 7. PORRUM *G. Don*, Mon. (1827) 4.—Bulb solitary, spherical or ovoid, devoid of a rhizome. Scape clothed \pm high up in the aerial part with leaf-sheaths. Segments of the perianth with one nerve. Filaments of the inner stamens trifid, with filiform lateral teeth, usually exceeding the central antheriferous one. Seeds angular. [Spp. 143-225.]

143. A. FERGANICUM *Vvedensky* in Not. Syst. Herb. Horti. Petrop. V (1924) 90.—A. *Lehmannianum* var. *kokanicum* Regel in A. H. P. X (1887) 304.

Bulb ovoid, 0.5-1 cm. thick; outer envelopes papyraceous, greyish; envelopes of the new bulb yellowish; bulblets few, large, dull, yellow, with a keel on the back. Scape 10-20 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 2-4, filiform, smooth, *c.* 1 mm. wide, apparently longer than the scape. Spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, with a short beak, early caducous. Umbel capsuliferous, hemispherical or more often spherical, many-flowered, dense; pedicels almost equal, $1\frac{1}{2}$ -3 times as long as the perianth, with bracteoles at the base. Segments of the campanulate perianth rose-coloured with a purple nerve, almost equal, 4-6 mm. long, acute, oblong-lanceolate. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, not ciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion equalling or $\frac{1}{3}$ shorter than the oblong-triangular base and slightly longer than or $1\frac{1}{2}$ times as long as the lateral portions. Style not exserted from the perianth. Valves of the capsule almost spherical, *c.* 4 mm. long. V.

Desert foothills.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from the foothills of the Alai and Turkestan ranges. Type at Leningrad.

144. *A. LEHMANNIANUM* *Mercklin* in *Mém. Acad. Pétersb.* VII (1851) 509; *Boiss. Fl. Or.* V (1882) 234, excl. var. *Bungei* *Boiss.*—*Ic.*: *Regel, Fl. Turk.* t. 6, f. 8-10.

Bulb ovoid, c. 0.75 cm. wide; outer envelopes papyraceous, greyish- or reddish-cinnamomeous, envelopes of the new bulb yellow; bulblets none. Scape 5-7 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 2-3, filiform, smooth, c. 1 mm. wide, exceeding the umbel. Spathe early caducous, half as long as the umbel, shortly acuminate. Umbel capsuliferous, hemispherical, more rarely spherical, comparatively few-flowered; pedicels with a few bracteoles at the base, almost equal, $1\frac{1}{2}$ -2-(3) times as long as the perianth. Segments of the campanulate perianth rose-coloured, with a strong purple nerve, smooth, equal, 6-7 mm. long, lanceolate or oblong, acute, the inner somewhat broader. Filaments slightly or $\frac{1}{3}$ shorter than the perianth-segments, connate, and adnate to the perianth, for $\frac{1}{4}$, not ciliate, the outer ones triangular-lanceolate, the inner scarcely broader than the perianth-segments at the base, trifid, with the middle portion $\frac{1}{3}$ as long as the oblong-triangular base and $\frac{1}{2}$ - $\frac{2}{3}$ as long as the laterals. Style not exerted from the perianth. Valves of the capsule circular, c. 4 mm. long, emarginate. V-VI.

Argillaceous deserts.—C. ASIA: 40 Aral-Casp., 43 Kyzl-Kum. Endemic. Descr. from the Aral desert. Type at Leningrad.

145. *A. BORSZCZOWI* *Regel* in *A. H. P.* III, 2 (1875) 74.—*Ic.*: *Regel, Fl. Turk.* (1876) t. 6, f. 11-14.

Bulb oblong-ovoid, 1-1.5 cm. thick; outer envelopes reticulate-fibrous, brown; envelopes of the new bulb yellowish; bulblets few, large, elongate, yellow, reticulate-striate. Scapes 10-30 cm. high, generally 2-3 from one bulb, more rarely solitary or up to 5, recurved-ascending on emergence from the sheaths, more rarely almost erect, clothed for $\frac{1}{4}$ - $\frac{1}{2}$ with glabrous approximate leaf-sheaths. Leaves 3-5, apparently fistular, narrowly linear, glabrous, 1-2 mm. wide, usually longer than the scapes. Spathe acuminate, twice to several times shorter than the umbel. Umbel capsuliferous, spherical, more rarely fasciculate, generally many-flowered, lax; pedicels with bracteoles at the base, unequal, 2-5 times as long as the perianth. Segments of the campanulate-hemispherical perianth rose-coloured with a darker nerve, almost equal, 5-6 mm. long, smooth, oblong-lanceolate or lanceolate, acute or obtuse. Filaments slightly or $\frac{1}{4}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the triangular base and slightly longer than or $\frac{1}{3}$ as long as the laterals. Style not exerted from the perianth. Valves of the capsule almost circular, c. 4 mm. long, generally with 2 cartilaginous teeth at the apex, forming (in the ovary stage) a corona surrounding the base of the style. IV-VI.

On sands and more rarely on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp., 43 Kyzye Kum, 44 Kara Kum, 45 Mountain Turkm., 46 Amu Dar., 47 Syr Dar. Endemic. Descr. from the Syr Darya valley. Type at Leningrad.

NOTE. The plants from the southern part of Central Asia, with short lateral teeth to the inner filaments and frequent absence of the corona on the ovary, approach (if they are not identical with) the north Persian *A. Boissieri* Regel. The question requires further investigation.

146. *A. BREVIDENS* *Vvedensky* in Not. Syst. Herb. Horti. Petrop. V (1924) 89.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes reticulate, brown, envelopes of the new bulb yellow, with reticulate nerves. Scape 20-30 cm. high, clothed half-way with scabrid or (the upper) smooth leaf-sheaths. Leaves 2-3, fistular, semicylindric, canaliculate, scabrid, 1-3 mm. wide, somewhat exceeding the umbel. Spathe early caducous, somewhat shorter than the umbel, with a beak $1\frac{1}{2}$ times exceeding the base of the spathe. Umbel capsuliferous, spherical or more rarely hemispherical, generally many-flowered, dense; pedicels with bracteoles at the base, 3-8 times as long as the perianth, unequal, the inner ones up to twice as long. Segments of the ovoid perianth whitish with a strong dirty-purple nerve, 3-4 mm. long, acute, smooth, the outer ones carinate, oblong, the inner elliptic. Filaments somewhat longer than the perianth, connate and adnate to the perianth at the base, eciliate, the outer ones subulate from a triangular base, the inner equalling the perianth-segments at the base, trifid, with the middle portion $1\frac{1}{2}$ -2 times as long as the laterals and as the oblong-triangular base. Style strongly exerted from the perianth. Valves of the capsule circular, c. 3.5 mm. long. V-VII. (Tab. XIV, fig. 2 a-d).

Outcrops of particoloured rocks.—C. ASIA: 48 Pam.-Al. Descr. from Karatag and Rink. Type at Leningrad.

147. *A. TURCOMANICUM* *Regel* in A. H. P. X (1887) 305, t. 1, f. 4.—Ic.: 1. c.

Bulbs solitary or more often aggregated 2-3 together, ovoid, 1-1.5 cm. thick; outer envelopes reticulate, rufescent-brown or brown; envelopes of the new bulb yellowish, with reticulate venation; bulblets few, large, elongate, yellow, smooth, shining. Scape 30-100 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves [sphalm. "fruits"] 4-5, fistular, semicylindric (?), smooth, 2-6 mm. wide, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, spherical, many-flowered, \pm dense; pedicels with bracteoles at the base, 3-5 times as long as the perianth, unequal, the inner ones $1\frac{1}{2}$ times as long. Segments of the ovoid perianth rose-violet, 5-6 mm. long, almost equal, acute, linear-lanceolate or lanceolate, smooth, the outer ones carinate. Filaments scarcely longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones subulate from a broadly triangular base, the inner scarcely broader than the perianth-

segments at the base, trifid, with the middle portion approximately equalling the laterals and the oblong-triangular base. Style scarcely exerted from the perianth. Valves of the capsule almost circular, transversely wrinkled, *c.* 3.5 mm. long. IV-V.

Clayey and sandy soils.—C. ASIA: 44 Kara Kum, 45 Mountain Turkm., 48 Pam.-Al. Endemic. Descr. from the region between Kalaburun and Abdulla Khan, near Murgab, south of Merv. Type at Leningrad.

148. *A. CRYSTALLINUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 126.

Bulb ovoid, *c.* 2 cm. thick; outer envelopes almost coriaceous, reticulate, grey-brown; envelopes of the new bulb yellow, reticulate; bulblets few, large, yellow, with reticulate venation, densely studded with crystalline tubercles. Scape 60 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 2, fistular, cylindric, smooth, 3-5 mm. wide, shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, many-flowered; pedicels 2-3 times as long as the perianth, with bracteoles at the base. Segments of the ovoid-campanulate perianth whitish with a reddish nerve, smooth, acute, 5 mm. long, the outer ones carinate, oblong-lanceolate, somewhat shorter than the linear-oblong inner ones. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion half as long as the laterals and the oblong-triangular base. Style not exerted from the perianth. V.

Juniper thickets.—C. ASIA: 48 Pam.-Al. Endemic. Collected once by Lepeshkin in a juniper thicket on the Ketmenchapta range near Aulata. Type at Tashkent.

149. *A. FILIDENS* *Regel* in A. H. P. III, 2 (1875) 174.—*Akrakense* *Regel* in A. H. P. III, 2 (1875) 176.—*A. Ugami* *Vvedensky* in Trans. Sci. Soc. Turk. I (1923) 123.—*A. margaritaceum* auct. Fl. As. Med.—*Id.*: *Regel*, Fl. Turk. (1876) t. 15, 11-13.

Bulb ovoid, 1-2 cm. thick; outer envelopes brown, reticulate-fibrous, surrounding the base of the scape; envelopes of the new bulb yellowish; bulblets few, yellowish or dark-brown, large, elongate, smooth, shining. Scape 20-60 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, smooth or slightly scabrid, 1-3 mm. wide, considerably shorter than the scape. Spathe caducous, equalling or $1\frac{1}{2}$ times as long as the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, spherical or hemispherical, many-flowered, dense; pedicels with bracteoles at the base, almost equal, 2-5 times as long as the perianth. Segments of the ovoid-campanulate perianth greenish-azure (in the dried state often rosy) with a strong green nerve, almost equal, 4-5 mm. long, smooth, the outer ones carinate, oblong, subobtusate, the inner oblong-obovate or

inversely oblong⁴², obtuse, with a little apiculus. Filaments equalling the perianth-segments or slightly shorter than it, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner $1\frac{1}{2}$ times as broad as the perianth-segments at the base, trifid, with the middle portion half as long as the ovate-triangular base and $\frac{2}{7}$ - $\frac{2}{3}$ as long as the laterals. Style not exserted from the perianth. Valves of the capsule circular, c. 4 mm. long, emarginate. V.-VI.

Rubbly slopes of the lower mountain zone, especially particoloured beds.—C. ASIA: 40 Aral-Casp. (Sary Su), 43 Kyzyl-Kum, 46 Amu Dar., 47 Syr Dar., 48 Pam.-Al., 49 Tien Shan. Descr. from the Mogol Tau. Type at Leningrad.

150. *A. DICTYOSCORDERUM* *Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 90.

Bulb ovoid, 2-2.5 cm. thick; outer envelopes reticulate, brown, surrounding the base of the stem high up, envelopes of the new bulb yellowish; bulblets none. Scape (sometimes 2 from one bulb) 50-70 cm. high, clothed at the base with smooth approximate leaf-sheaths. Leaves 4-6, edentate, linear, canaliculate, strongly scabrid on the margin, 3 mm. wide, considerably shorter than the scape. Spathe somewhat longer than the umbel, with a beak equalling the base of the spathe. Umbel capsuliferous, spherical, more rarely hemispherical, dense, generally many-flowered; pedicels with bracteoles at the base, $1\frac{1}{2}$ -3 times as long as the flowers, almost equal. Segments of the ovoid-campanulate perianth whitish with a green nerve, almost equal, 5-6 mm. long, linear-oblong, obtuse or subobtuse, the outer ones carinate, scabrid. Filaments almost equalling the perianth-segments, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner almost twice as broad as the perianth-segments at the base, trifid, with the middle portion half as long as the ovate-triangular base and half as long as the laterals. Style not exserted from the perianth. Valves of the capsule almost circular, c. 5 mm. long, scarcely emarginate. V.-VI.

Saline clays in the lower mountain zone.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Hermab. Type at Leningrad.

151. *A. VIRIDE* *Grossheim*, Fl. Kavk. I (1928) 201.

Envelopes of the bulb reticulate-fibrous, attenuate into a long neck 2-3 times as long as the bulb itself. Scape 70-150 cm. high, with a glaucous "bloom." Leaves hollow, cylindric, rapidly narrowing towards the apex, 6-11 mm. wide, up to 40 cm. long. Spathe early caducous. Umbel capsuliferous, oval-spherical, dense, 3.5-4 cm. in diameter; pedicels extremely unequal, 3-5 times as long as the perianth. Segments of the oblong-oval perianth dull-green, narrowly white-edged on the margin, very obtuse, smooth, 3-5 mm. long. Filaments longer than the perianth-segments, glabrous, more rarely sparsely ciliate, the outer ones shorter than the inner, without teeth or with 1-2 short teeth at the sides, the inner with 3 equal teeth.

⁴² [Possibly a slip for "inversely ovate", i. e. "obovate". —Note by translator.]

CAUCASUS: 25 Talysh. Endemic.

Note. I have seen no specimen of this species.

152. *A. dictyoprasum* C. A. Meyer ex Kunth, Enum. IV (1843) 390; Ledeb. Fl. Ross. IV (1852) 166; Boiss. Fl. Or. V. (1882) 243.

Bulb ovoid, 2-2.5 cm. thick; outer envelopes brown, reticulate, surrounding the scape high up; envelopes of the new bulb yellowish; bulb-lets few, large, yellow, elongate, reticulate-nerved, commonly absent. Scape 60-100 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, fistular, cylindric, narrowing towards the apex, smooth, 3-5 mm. wide, considerably shorter than the scape. Spathe approximately equaling the umbel, with a short beak. Umbel capsuliferous, spherical, dense, many-flowered; pedicels with bracteoles at the base, 2-3 times as long as the perianth, unequal, the inner ones twice as long as the outer. Segments of the oblong-ovoid perianth dark-purple or brown-green, with a darker nerve, smooth, c. 3 mm. long, unequal, the outer ones cymbiform, broadly elliptic, very obtuse, considerably shorter than the ovate emarginate inner ones. Filaments $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner narrower than the perianth-segments at the base, trifid, with the middle portion slightly shorter than the linear-triangular base and slightly longer than or half as long as the laterals. Style strongly exserted from the perianth. Valves of the capsule almost circular, 3.5 mm. long, scarcely emarginate at the apex. VI-VII. (Tab. XIV, fig. 1a).

In dry stony places.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Armenia. Cotype at Leningrad.

153. *A. vineale* Linné, Sp. Pl. (1753) 299; Ledeb. Fl. Ross. IV (1852) 163; Boiss. Fl. Or. V. (1882) 235; Schmalh. Fl. II (1897) 486.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1075.—Exs.: Pl. Finl. exs. no. 573.

Bulb ovoid, 1.5-2 cm. thick; outer envelopes grey-brown, papyraceous, \pm lacerate; envelopes of the new bulb yellowish, shining, smooth. Scape 40-80 cm. high, clothed for $\frac{1}{3}$ or $\frac{1}{2}$ with smooth sheaths. Leaves 3-4, fistular, semi-cylindric, canaliculate, smooth, 2-4 mm. wide, considerably shorter than the scape. Spathe approximately equalling the umbel, with a long beak, quickly caducous. Umbel with bulbils, more rarely without them, few- or many-flowered, sometimes entirely without flowers; pedicels several times as long as the perianth, almost equal, with bracteoles at the base. Segments of the ovoid perianth rose or purple with a darker nerve, 3-4.5 mm. long, obtuse, smooth, the outer ones oblong, carinate, somewhat broader than the oblanceolate inner ones. Filaments slightly or $1\frac{1}{2}$ times longer than the perianth-segments, connate at the base and adnate to the perianth, slightly ciliate at the base, the outer ones subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion slightly or $\frac{1}{3}$ shorter than the laterals, and slightly shorter than the linear-triangular base or equaling it. Style strongly exserted from the perianth. Valves of the capsule elliptic, c. 4 mm. long, narrowly and shallowly emarginate. VII-VIII.

In mountain meadows; in the European part as a weed.—EUROPEAN PART: 12 Middle Dnepr, 17 Crimea; CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: W. Eur., Asia Min., N. Amer. (introduced). Descr. from Germany.

154. *A. AUCHERI* Boissier, Diagn. Pl. Or. 1, 7 (1846) 116; Boiss. Fl. Or. V (1882) 237.—*A. brevipes* Ledebour, Fl. Ross. IV (1852) 165.—*A. ledschanense* Conrath et Freyn in Bull. Herb. Boiss. IV (1896) 190.

Bulb ovoid, c. 1 cm. thick; outer envelopes dark-grey, almost coriaceous, splitting; envelopes of the new bulb yellowish; bulblets none. Scape 40-70 cm. high, clothed half-way or slightly higher with smooth or slightly scabrid leaf-sheaths. Leaves 2-(4), fistular, apparently semicylindric, canaliculate, smooth or slightly scabrid, c. 3 mm. wide, short, falling far short of the umbel. Spathe often purple-coloured, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, without a beak, acuminate. Umbel capsuliferous, spherical, more rarely hemispherical, more often many-flowered, dense, almost capitate; pedicels without bracteoles, unequal, the outer ones half as long as the perianth, more rarely equalling or up to $1\frac{1}{2}$ times as long as it, the inner equalling or twice as long as the perianth. Segments of the tubular-campanulate perianth equal, 7-9 mm. long, purple-rose (becoming lilac in the dry state), with a dirty-purple nerve, oblong-lanceolate, very acute, smooth, or sometimes denticulate on the nerve. Filaments half as long as the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$ as long as the ovate-triangular base and $\frac{1}{3}$ - $\frac{1}{2}$ as long as the laterals. Style not exerted from the perianth. Valves of the capsule elliptic, c. 6 mm. long, slightly emarginate at the apex. VI-VII. (Tab. XIV, fig. 3 a, b).

In subalpine meadows.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Asia Min., N. Persia. Descr. from Armenia and Gilan.

Note. Judging by the very detailed description of *A. ledschanense*, this species differs from *A. Aucheri* only in the non-fistular leaves. Taking into consideration how difficult it sometimes is to make out this character from dried material, I think that an error has arisen here, and that it is impossible to separate these species.

155. *A. GUTTATUM* Steven in Mén. Soc. Nat. Mosc. XVIII (1809) 173, tab. 2, f. 1; Ledeb. Fl. Ross. IV (1852) 165.—*A. margaritaceum* var. *guttatum* J. Gay in Ann. Sci. Nat. sér. 3, VIII (1847) 223; Boiss. Fl. Or. V (1882) 240; Schmalh. Fl. II (1897) 487.—Ic.: Stev. 1. c.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey or brownish, papyraceous, with slender parallel nerves, sometimes torn into fibres above; envelopes of the new bulb whitish; bulblets solitary (?), large, smooth, greyish. Scape 30-60 cm. high, slender, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, scabrid, 1.5-3 mm. wide, considerably shorter than the scape. Spathe approximately equalling the umbel, early caducous, with a long beak twice as long as the base of the spathe. Umbel capsuliferous, dense, many-

flowered, spherical, more rarely hemispherical; pedicels several times as long as the perianth, unequal, the central ones twice as long as the outer, very slender, thickened beneath the flower, the outer ones with long membranous bracteoles at the base, almost equalling the pedicels and surrounding the base of the umbel. Segments of the narrowly campanulate perianth *c.* 2.5 mm. long, whitish, with an inconspicuous dirty-greenish nerve and with a dark-violet, in the dry state brownish-greenish, blotch in the middle, smooth, obtuse, the outer ones slightly carinate, inversely oblong [*sic!*], the inner inversely oblong-linear [*sic!*], slightly narrower and slightly broader than the outer. Filaments $\frac{1}{4}$ longer than the perianth-segments, connate at the base and adnate to the perianth, glabrous, the outer ones subulate, the inner broader than the perianth-segments at the base, trifid, with the middle portion $\frac{1}{2}$ - $\frac{2}{3}$ as long as the filiform laterals and equaling or $\frac{1}{3}$ shorter than the linear-triangular base. Style somewhat exserted from the perianth. Valves of the capsule broadly elliptic, narrowly emarginate, *c.* 3 mm. long. VI-VII.

On steppes, sands and hills.—EUROPEAN PART: 16 Black Sea, 17 Crimea; CAUCASUS: 23 E. Transcauc. (?). Gen. Distr.: Balkans-Asia Min. Descr. from the lower Dnestr. Cotype at Leningrad.

Note. Indicated for E. Transcaucasia in Wilhelms' collections. I have not seen these specimens, and on the whole consider the occurrence of this onion in Transcaucasia to be extremely doubtful.

156. A. AFFINE *Ledebour*, Fl. Ross. IV (1852) 166.—*A. margaritaceum* var. *affine* Regel in A. H. P. III, 2 (1875) 50; Boiss. Fl. Or. V (1882) 240.—*A. margaritaceum* var. *scabrum* Regel, l. c.—*A. Mishtshenkoanum* Grossheim in Grossheim et Shinshkin, Sched. Herb. Pl. Or. Exsicc. Fasc. I-VIII (1924) no. 4.—Exs.: Pl. Or. exs. no. 352.

Bulb ovoid, 1-2 cm. thick; outer envelopes grey, papyraceous; envelopes of the new bulb yellowish; bulblets solitary (?), large, smooth, yellowish. Scape (20)-30-80 cm. high, clothed up to half-way with scabrid, more rarely smooth leaf-sheaths. Leaves 3-5, fistular, semicylindric, canaliculate, scabrid, 2-4 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, early caducous, with a long beak 3-4 times exceeding the base of the spathe. Umbel capsuliferous, dense, many-flowered, spherical, very rarely hemispherical; pedicels 3-4 times as long as the perianth, generally unequal, the central ones twice as long as the outer, very slender, thickened beneath the flower, the outer ones with long, often capillary, membranous bracteoles at the base, sometimes equalling the pedicels, surrounding the base of the umbel. Segments of the narrowly campanulate perianth *c.* 4 mm. long, whitish, with a strong green nerve, smooth, obtuse, the outer ones carinate, oblong, the inner oblong-linear, somewhat narrower and longer than the outer. Filaments $\frac{1}{4}$ - $\frac{1}{3}$ longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the inner ones broader than the perianth-segments at the base, trifid, with the middle portion half as long as the filiform laterals and scarcely shorter than the

linear-triangular base. Style exserted from the perianth. Valves of the capsule elliptic or obovate, narrowly emarginate, *c.* 5 mm. long. VI-VIII.

On dry slopes.—CAUCASUS: 21 Dag. 23 E. and 24 S. Transcauc., 25 Talysh. Gen. distr.: Iran. Descr. from Georgia. Type at Leningrad.

157. *A. FIRMO-TUNICATUM* *Fomin*. in Monit. Jard. Tifl. 14 (1909) 48.

Bulb ovoid-spherical; envelopes coriaceous, hard, \pm splitting above into parallel laciniae; bulblets yellowish-brown, finely tuberculate. Scape up to 60 cm. high, clothed half-way with leaf-sheaths. Leaves fistular, cylindric, striate, scabrid, shorter than the scape. Spathe with a long beak, early caducous. Umbel hemispherical or sometimes almost spherical; pedicels vinous-red, unequal, the inner ones twice as long, 4-5 times as long as the perianth, with bracteoles at the base. Segments of the triquetrous-campanulate perianth vinous-red with a crimson tinge, connivent, oval-oblong, obtuse, 3.5 mm.⁴³ long, the outer ones strongly carinate, scabrid on the margin, strongly coloured. Filaments longer than the perianth-segments, widened at the base, the outer ones entire, the inner trifid, with the middle portion $\frac{1}{3}$ shorter than the laterals. Style exserted from the perianth. VI.

In dry places.—CAUCASUS: 23 E. Transcauc. Endemic (?). Descr. from the Mil. Steppe.

Note. I have seen no specimen of this species.

158. *A. FUSCO-VIOLACEUM* *Fomin* in Monit. Jard. Bot. Tifl. 14 (1909) 50.—Exs.: Pl. Or. exs. no. 56.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes papyraceous, grey; envelopes of the new bulb yellowish; bulblets solitary (?), large, yellowish, smooth, shining. Scape 30-70 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, usually scabrid on the margin, 2-3 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, with a short beak. Umbel capsuliferous, spherical or even hemispherical, many-flowered, dense; pedicels almost equal or the inner ones up to half as long again, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the oblong-ovoid perianth *c.* 4 mm. long, dark- or more rarely light-purple, with a darker nerve, oblong, almost equal, smooth, the outer ones obtuse, carinate. Filaments somewhat longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer one subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion almost equalling the laterals,⁴⁴ and half as long as the

⁴³ [Sphalm. "3-5 mm." in original, but cf. key, 112th. dichotomy. —*H. K. A. S. & W. T. S.*]

⁴⁴ [In the original description of *A. fuscoviolaceum* the middle anther-bearing upper portion of the inner filaments is described as often twice as long as, or about as long as, the two lateral portions. The type was collected on the mountain Askar Dag near Sarykamys in the Kars region. —*W. T. S.*]

narrowly linear-triangular base. Style exserted from the perianth. Valves of the capsule broadly elliptic, c. 4 mm. long, shallowly emarginate. VII-VIII.

On dry slopes.—CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. and 24 S. Transcauc. Gen. distr.: Iran. Descr. from Sary Kamysh. Type at Tiflis.

159. *A. SPHAEROCEPHALON* ⁴⁵ *Linné*, Sp. Pl. (1753) 297; Ledeb. Fl. Ross. IV (1852) 165, excl. spec. Transcauc.; Boiss. Fl. Or. V (1882) 236; Schmalh. Fl. II (1897) 486.—*A. descendens* auct. Fl. Ross.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1080.—Exs.: Fl. Hung. exs. no. 793.

Bulb ovoid, 0.75-2 cm. thick; outer envelopes coriaceous, brown, entire, splitting; envelopes of the new bulb yellowish; bulblets few or wanting (?), elongate, yellowish, shining, smooth. Scape 30-80 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-5, fistular, semicylindric, canaliculate, smooth, rarely scabrid on the margin, 2-4 mm. wide, considerably shorter than the scape. Spathe half as long as the umbel, with an apiculus. Umbel capsuliferous, spherical or oblong, more rarely fasciculate-hemispherical, many-flowered, dense; pedicels unequal, the central ones generally up to twice as long as the outer, equalling or twice to many times as long as the perianth, the outer ones with bracteoles at the base. Segments of the oblong-ovoid perianth c. 4 mm. long, rose or purple with a darker nerve, very rarely whitish, oblong, the outer ones carinate, \pm scabrid, subacute, slightly shorter and narrower than the obtuse inner ones. Filaments slightly or $\frac{1}{4}$ longer than the perianth-segments; connate and adnate to the perianth at the base, \pm ciliate at the base, the outer ones subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion almost equalling the latter and ($\frac{1}{2}$)- $\frac{2}{3}$ as long as the linear base. Style strongly exserted from the perianth. Valves of the capsule elliptic, c. 4 mm. long, scarcely emarginate, with cartilaginous teeth. VI-VII.

On steppes, hills, slopes,—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga (?); CAUCASUS: 20 Ciscauc. Gen. Distr.: S. and C. Eur., Asia Min. (?), N. Afr. (?). Descr. from Italy.

Note. *A. descendens* L. differs, apart from other characters, in the leaves being carinate below. The study of living material will settle finally the question of the occurrence of this species in the U S S R. To the *A. descendens* form-cycle belongs also the form noted by Mishchenko as *A. artvinense*.

160. *A. REGELIANUM* *Becker* ex Ilyin in Fl. Yugo-Vost. III (1929) 355 et 356, fig. 178.—*A. descendens* var. *tenuifolium* Mishchenko ex Grossheim, Fl. Kavk. I (1928) 252.—Ic.: Fl. Yugo-Vost., l. c.

Bulb ovoid, 0.75-1 cm. thick; outer envelopes almost coriaceous, greyish-brownish, entire, splitting; envelopes of the new bulb yellowish-

⁴⁵ [Spelled *A. SPHAEROCEPHALUM* by Vvedensky and most authors but *A. SPHAEROCEPHALON* by Linnaeus. —W. T. S.]

brownish; bulblets numerous, small, semi-ovoid, yellowish-brownish or more often brown, matt owing to the projecting nerves. Scape 30-60 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, fistular, semicylindric, canaliculate, smooth, 2 mm. wide, considerably shorter than the scape. Spathe caducous, considerably shorter than the umbel. Umbel capsuliferous, fasciculate-oblong, dense, many-flowered; pedicels unequal, the outer ones almost equalling the perianth, with bracteoles at the base, the inner 4 times as long, without bracteoles. Segments of the ovoid perianth almost equal, c. 4 mm. long, purple, with a darker nerve, obtuse, smooth, the outer ones carinate, oblong or oblong-lanceolate or lanceolate. Filaments equalling or slightly longer than the perianth, connate and adnate to the perianth at the base, almost glabrous, the outer ones subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion slightly shorter than the laterals and $\frac{1}{3}$ - $\frac{1}{2}$ as long as the linear-triangular base. Style strongly exserted from the perianth. Valves of the capsule elliptic, c. 3 mm. long, scarcely emarginate, with cartilagineous teeth. VIII.

In salt-marshes.—EUROPEAN PART: 16 Black Sea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 21 Dag.⁴⁶ Endemic. Descr. from Krasnoarmeisk. Type at Leningrad.

161. A. SCORODOPRASUM *Linné*, Sp. Pl. (1753) 297, excl. var. B; Ledeb. Fl. Ross. IV (1852) 163; Boiss. Fl. Or. V (1882) 232; Schmalh. Fl. II (1897) 486.—Ic.: Reichb. Ic. Fl. Germ. X (1848) f. 1073.—Exs.: Hayek, Fl. Stir. exs.

Bulb ovoid, 1-2 cm. thick; outer envelopes cinnamomeous, almost coriaceous, breaking up; envelopes of the new bulb dark violet; bulblets small, numerous, smooth, dark-violet. Scape 40-80 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-5, linear, not fistular, gradually narrowed to the apex, scabrid on the margin and central nerve, very short, scarcely exceeding the middle of the scape, 4-10 mm. wide. Spathe longer than the umbel, early caducous, with a beak up to twice as long as the base of the spathe. Umbel with violet bulbils, \pm many-flowered, very rarely without flowers; pedicels twice as long as the perianth, equal, with bracteoles at the base. Segments of the ovoid-campanulate perianth c. 5 mm. long, purple with a darker nerve, acute, scabrid, the outer ones oblong, carinate, somewhat narrower than the oblong-ovate inner ones. Filaments slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones subulate, the inner scarcely broader than the perianth-segments at the base, trifid, with the middle portion half as long as the laterals and $\frac{1}{3}$ as long as the oblong-triangular base. Style not exserted from the perianth. VI-VII.

⁴⁶ Derbent, *Becker* — requires confirmation.

In meadows, amongst bushes.—EUROPEAN PART: 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 16 Black Sea, 17 Crimea; CAUCASUS: 20 Ciscauc. (Kislovodsk, Akinfiev). Gen. distr.: W. Eur., Asia Min. Descr. from Europe.

162. *A. LONGICUSPIS* Regel in A. H. P. III, 2 (1875) 45.—*A. sativum* auct. fl. As. Med.—Ic.: Regel, Fl. Turk. (1876) t. 6, f. 1-3.

Bulb ovoid, 1-2 cm. thick; new bulbs 2-4; outer envelopes grey-brown, papyraceous, almost coriaceous; envelopes of the new bulbs greyish-rosy; bulblets none. Scape 40-100 cm. high, clothed half-way with smooth leaf-sheaths. Leaves 4-7, not fistular, broadly linear, smooth, or scabrid on the margin and on the mid-nerve below, 5-10 mm. wide, considerably shorter than the scape. Spathe 3-4 times as long as the umbel, with a long, strong beak, up to 4 times as long as the base of the spathe, caducous. Umbel with large (5-10 mm.) violet bulbils, intermingled with numerous membranous bracteoles exceeding the bulbils, many-flowered, ovoid, \pm dense; pedicels filiform, several times as long as the flower, unequal, the inner up to 3 times ⁴⁷ as long. Segments of the ovoid perianth rose-coloured, sometimes deep-rose, shining, smooth, equal, c. 3 mm. long, acute, the inner ones ovate, the outer oblong. Filaments at first shorter than the perianth-segments, afterwards up to $1\frac{1}{2}$ times as long as them, connate and adnate to the perianth at the base, eciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, 3-(5)-fid, with the middle portion almost twice as long as the oblong base and $\frac{1}{3}$ - $\frac{1}{2}$ as long as the laterals, which are sometimes provided with teeth. Style strongly exserted from the perianth. VII-VIII.

In shade at the bottom of gorges.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Taka. Type at Leningrad.

Note. *A. longicuspis* is the wild race of *A. sativum* L. (garlic), differing in the exserted anthers. In *A. longicuspis*, as in many onions possessing bulbils in the umbel, the flowers apparently do not always develop, and then the anthers are not exserted from the perianth. Observations on this species in cultivation are desirable.

In the plants from Mountain Turkmenia the stamens are somewhat less exserted from the perianth, but I have had too little material thence with well-developed flowers to be able to say whether this is generally characteristic of them.

(163). *A. SATIVUM* Linné, Sp. Pl. (1753) 296; Schmalh. Fl. II (1897) 486.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 237.

Bulb ovoid, consisting of several (6-10) small bulblets. Scape up to 1 m. high, before flowering often coiled into a ring in the upper part. Leaves flat, linear. Spathe with a long beak. Umbel with numerous bulbils. Perianth whitish. Filaments shorter than the perianth, the

⁴⁷ ["Up to 5 times as long" may be intended: Regel describes the pedicels as 12-15 mm. long, the perianth-segments 3 mm. long. —W. T. S.]

inner ones trifid with long lateral teeth. Cultivated plant. Propagated by offsets, since it practically never sets seed.

ECONOMIC IMPORTANCE. Grown in the European part of the U S S R, in the Caucasus and in the Far East, for the sake of the bulbs, which are stored up. It is used as a medicinal plant for arterio-sclerosis. Besides oil of garlic, it contains the glucoside allin.

164. *A. FOMINIANUM* *Mishchenko ex Grossheim et Shishkin*, Sched. Herb. Pl. Or. Exsicc. (1924) no. 80.—*A. Fomini* Mishchenko in herb.—*A. ampeloprasoides* Grossheim in Grossheim et Shishkin, l. c. (1924) no. 31.—Exs.: Pl. Or. exs. no. 80.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, brown, with indistinct parallel nerves, splitting, envelopes of the new bulb dark-purple-violet; bulblets few, often wanting, brown, matt, with slender nerves. Scape 20-60 cm. high, clothed for $\frac{1}{4}$ with smooth leaf-sheaths. Leaves (2)-3-4, not fistular, linear, canaliculate, scabrid on the margin or more rarely smooth, 2-3 mm. wide, considerably shorter than the scape. Spathe quickly caducous. Umbel capsuliferous, spherical or more rarely hemispherical, many-flowered; pedicels almost equal, $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth whitish, sometimes \pm purple on the back, with a green or purple nerve, c. 4 mm. long, obtuse, scabrid, the outer ones oblong, carinate, \pm denticulate on the keel, $\frac{1}{3}$ narrower and scarcely shorter than the ovate inner ones. Filaments equalling the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the ovate-triangular base and half as long as the laterals. Style scarcely exerted from the perianth. Valves of the capsule almost circular, c. 4 mm. long. V-VII.

On rocks and stony slopes.—CAUCASUS: 23 E. Transcauc. Endemic. Descr. from Tiflis. Type at Baku.

NOTE. Exceedingly close to *A. ponticum*, and is, judging from the labels, a pale-flowered, more northern ecological race, characteristic of rocks and stony slopes. These species need to be distinguished in the field, since the characters given by Grossheim (Fl. Kavk. l. c.), for the separation of *A. Fomini*, *A. ampeloprasoides* and *A. ponticum*, have no existence in actuality.

165. *A. PONTICUM* *Mishchenko ex Grossheim*, Fl. Kavk. I (1928) 206.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes almost coriaceous, splitting, envelopes of the new bulb dark-purple or reddish-brown; bulblets wanting (?). Scape 20-70 cm. high, clothed for $\frac{1}{4}$ with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, smooth, or more rarely scabrid on the margin, 2-5 mm. wide, considerably shorter than the scape. Spathe quickly caducous. Umbel capsuliferous, spherical or more rarely hemispherical, many-flowered; pedicels almost equal, 2-3 times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth dark-purple, c. 4 mm. long, obtuse,

scabrid, the outer ones oblong, carinate, $\frac{1}{3}$ narrower than the broadly ovate outer ones. Filaments equalling or slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{3}$ as long as the ovate-triangular base and half as long as the laterals. Style scarcely exserted from the perianth. Valves of the capsule almost circular, c. 4 mm. long. V-VII.

On dry slopes.—CAUCASUS: 22 E. and 23 W. Transcauc. Descr. from Transcaucasia. Type at Leningrad.

166. *A. GRACILESCENS* *Sommier et Levier* in *A. H. P.* XIII (1893) 51.

Bulb c. 1 cm. thick; outer envelopes greyish-brownish, almost coriaceous, splitting; envelopes of the new bulb reddish-brown, bulblets . . . Scape c. 50 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3, not fistular, linear, apparently canaliculate, smooth, or slightly scabrid on the margin, 3-4 mm. wide, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, hemispherical, lax; pedicels almost equal, 3-3½ times as long as the perianth, with bracteoles at the base. Segments of the globose-campanulate perianth light-rose, 4-5 mm. long, obtuse, scabrid, the outer ones oblong, carinate, $\frac{1}{3}$ narrower than the ovate inner ones. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones linear-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{3}$ as long as the ovate-triangular base and $\frac{2}{5}$ - $\frac{1}{2}$ as long as the laterals. Style not exserted from the perianth. VI.

CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Adzharia: Keda. Type at Florence.

A species exceedingly close to *A. Fominianum* and *A. ponticum*; it is possible that one of these names will have to give place to the name *A. gracilescens*, which has priority. Besides the type, which I have been able to see, there are no other specimens in herbaria.

Sommier and Levier describe their species as having light-rose flowers, and do not lump it with *A. ponticum*, since the last of their collections (Chula), which has preserved its dark-purple hue to the present day, is referred by them to *A. rotundum*. The type of *A. gracilescens* has faded so much that it is quite impossible to say what colour its flowers were: hence I am unable to identify it with *A. ponticum*, to which it is nearer both in its lax umbel and western provenance. But owing to these latter facts I cannot unite *A. gracilescens* with *A. Fominianum* either.

All this compels me to keep all these three species, for the present, distinct, and to direct the attention of workers on the Caucasian flora to the foregoing remarks. Cf. also my note on *A. Fominianum*.

167. *A. ERUBESCENS* *C. Koch* in *Linnaea* XXII (1849) 242.—*A. rudbaricum* Boissier et Buhse in *Nouv. Mém. Soc. Nat. Mosc.* XII (1860) 215; Boiss. *Fl. Or.* V (1882) 240.—*A. rotundum* ssp. *gramineum* Mishchenko in herb.—Exs.; *Pl. Or.* exs. no. 32.

Bulb ovoid, (0.5)-1-1.5 cm. thick; outer envelopes brown or grey-brown, coriaceous, splitting, split into fibres in the upper part; envelopes of the new bulb purple-cinnamomeous; bulblets few, small, brown, almost smooth. Scape 20-40 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, smooth, or scabrid on the margin, 2-5 mm. wide, considerably shorter than the scape. Spathe early caducous, equalling the umbel, with a beak almost equalling, or half as long as, the base of the spathe. Umbel capsuliferous, spherical or more rarely hemispherical, dense, generally many-flowered; pedicels with bracteoles at the base, unequal, the outer ones $1\frac{1}{2}$ times as long as the perianth, more rarely shorter than it, the inner up to 3 times as long as the perianth. Segments of the campanulate perianth rose with a purple nerve, 5-7 mm. long, acute, scabrid, the outer ones lanceolate, sometimes slightly longer than the oblong inner ones, carinate, \pm denticulate on the keel, sometimes slightly reflexed at the apex. Filaments $\frac{1}{4}$ or $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the linear-triangular base and $\frac{1}{3}$ - $\frac{1}{2}$ as long as the laterals. Style not exerted from the perianth. Valves of the capsule broadly oval, c. 5 mm. long. VI-VII.

In meadows and amongst bushes.—EUROPEAN PART: 17 Crimea (rarely); CAUCASUS: 20 Ciscauc., 21 Dag., 23 E. Transcauc., 25 Talysh. Gen. distr.: N. Persia. Descr. from Dagestan: Kuba. Type at Berlin.

168. *A. ROTUNDUM* Linné, Sp. Pl. (1762) 423; Ledeb. Fl. Ross. IV (1852) 164, p. p.; Boiss. Fl. Or. V (1882) 233; Schmalh. Fl. II (1897) 487, p. p.—*A. cilicicum* Boissier, Diagn. Pl. Or. I, 7 (1846) 115; Boiss. Fl. Or. V (1882) 242.—*A. rotundum* ssp. *scoro[do]prasoides* Mishchenko in herb.

Bulb ovoid, 0.75-2 cm. thick; outer envelopes brown or black-brown, coriaceous, splitting, in the upper part \pm split into fibres; envelopes of the new bulb black-brown; bulblets \pm numerous, small, brown, almost smooth. Scape 20-50 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-5, not fistular, linear, canaliculate, scabrid or smooth on the margin, 2-5-(7) mm. wide, considerably shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak approximately equalling the base of the spathe. Umbel capsuliferous, spherical, more rarely hemispherical, dense, more often compressed or almost capitate; pedicels with bracteoles at the base, unequal, the outer ones equalling the perianth, more rarely twice as long as it, the inner ones twice, more rarely 5 times as long as the perianth. Segments of the broadly campanulate perianth c. 5 mm. long, almost equal, scabrid, the outer ones dark purple with a darker nerve, carinate, \pm denticulate on the keel, oblong, obtuse or subobtuse, the inner lighter, more often almost white, with a purple nerve, elliptic, very obtuse. Filaments $\frac{1}{4}$ shorter than the perianth-segments, connate and adnate to the perianth

at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifold, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the oblong-triangular base and $\frac{2}{5}$ as long as the laterals. Style not exerted from the perianth. VI-VII.

EUROPEAN PART: 16 Black Sea, 17 Crimea; CAUCASUS: 20 Ciscauc., 22 W., 23 E., & 24 S. Transcauc., 25 Talysh. Gen. distr.: C. and S. Eur. Asia Min., N. Iran. Descr. from southern Europe.

An attempt—to some extent forced—has here been made to distinguish species within *A. rotundum* s. l. I separate these species principally on the colour and form of the perianth-segments. I have been unable to make use of other characters, extremely important for the taxonomy of *Allia* (bulb-envelopes, bulblets), owing to the material in the great majority of cases being badly collected. A very material factor also has been the almost complete lack of ecological data on the labels of the Crimean—Caucasian material.

It is extremely probable that *A. rotundum* s. l. in the Crimea and Caucasus forms a series of local races, the study of which can only be successful (as always) when specially collected material is available.

169. *A. JAJLAE* Vvedensky in Bull. Univ. As. Centr. 19 (1934) 126. —*A. rotundum* ssp. *melleum* Mishchenko in herb.

Bulb ovoid, 1-1.5 cm. thick; outer envelopes grey-brown, almost coriaceous, splitting into fibres in the upper part, envelopes of the new bulb black-brown; bulblets few, small, brown, almost smooth. Scape 20-40 cm. high, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 3-5, not fistular, linear-canaliculate, scabrid on the margin, 3-5 mm. wide, considerably shorter than the scape. Spathe early caducous, half as long as the umbel, with a beak somewhat exceeding the base of the spathe. Umbel capsuliferous, spherical, dense, more often almost capitate; pedicels with bracteoles at the base, unequal, the outer ones almost equalling the perianth or slightly longer than it, the inner up to 3 times as long, segments of the ovoid-campanulate perianth rose-violet with a darker nerve, almost equal, c. 5 mm. long, scabrid, the outer ones carinate, denticulate on the keel, oblong, subacute or subobtuse, the inner oblong-ovate, obtuse or subobtuse. Filaments $\frac{1}{4}$ or almost $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifold, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the oblong-triangular base and $\frac{2}{5}$ as long as the laterals. Style not exerted from the perianth. Valves of the capsule broadly elliptic, c. 3 mm. long, scarcely emarginate. VI-VII.

On mountains.—EUROPEAN PART: 17 Crimea; CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Asia Min. Descr. from the Crimea: the Nikita Yaila. Type at Leningrad.

NOTE. I distinguished this species, in the *A. rotundum* (s. l.) group, chiefly by the compressed, often almost capitate umbel of rose-coloured flowers; it would be possibly more correct to regard the whole Crimean-Caucasian rose-coloured material of this cycle as a distinct species, irrespective of the density of the umbel.

170. *A. WALDSTEINI* *G. Don*, Mon. (1827) 17.—*A. rotundum* Ledebour, Fl. Ross. IV (1852) 164, p. p.; Schmalh. Fl. II. (1897) 487, p. p.—*A. paterfamilias* Boissier Diagn. Pl. Or. II, 4 (1859) 114 (?).—[Ic.: Waldstein et Kitaibel, Pl. Rar. Hung. (1801) t. 82.]

Bulb ovoid, 1-2 cm. thick; outer envelopes brown, coriaceous, splitting; envelopes of the new bulb dark purple; bulblets numerous, small, black-purple. Scape (30)-40-70 cm. high, clothed for $\frac{1}{3}$ or almost $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 4-5, not fistular, linear, canaliculate, smooth, or scabrid on the margin, 3-7-(10) mm. wide, considerably shorter than the scape. Spathe early caducous, somewhat longer than the umbel, with a beak equalling the base of the spathe or $1\frac{1}{2}$ times as long. Fruiting umbel spherical or more rarely hemispherical, dense, many-flowered; pedicels with bracteoles at the base, unequal, the outer ones $1\frac{1}{2}$ -2, the inner 3-5 times as long as the perianth, more rarely (in impoverished specimens) the outer ones equalling the flowers, the inner twice as long. Segments of the ovoid-pyramidal perianth dark-purple-violet with a darker nerve, (4)-5 mm. long, almost equal, scabrid, the outer ones carinate, denticulate on the keel, oblong, acute, the inner oblong-ovate, subacute or subobtuse or apiculate. Filaments $\frac{1}{4}$ or almost $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer ones triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{4}$ - $\frac{1}{3}$ as long as the oblong-triangular base and half as long as the laterals. Style not exerted from the perianth. Valves of the capsule almost circular, c. 4 mm. long, scarcely emarginate. VI-VII.

In meadows, on slopes, more often as a weed.—EUROPEAN PART: 9 Upper Volga, 10 Volga-Kama, 11 Upper Dnepr, 12 Middle Dnepr, 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc. Gen. distr.: C. and S (?) Eur. Descr. from Hungary.

171. *A. TALYSCHENSE* *Mishchenko* ex Grossheim, Fl. Kavk. I (1928) 204.

Bulb ovoid, 0.75-1.5 cm. thick; outer envelopes light-brown, almost coriaceous, split into fibres, especially at the apex; envelopes of the new bulb yellowish; bulblets few, small, yellowish, shining, almost smooth. Scape 15-30 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 3-4, not fistular, linear, canaliculate, scabrid, c. 3 mm. wide, considerably shorter than the scape. Spathe caducous, somewhat shorter than the umbel, with a beak approximately $\frac{1}{3}$ as long as the base. Umbel capsuliferous, spherical or more rarely hemispherical, dense, many-flowered; pedicels almost equal, $1\frac{1}{2}$ -2 times as long as the perianth, with bracteoles at the base. Segments of the broadly campanulate perianth almost white, with a strong dirty-purple nerve, almost equal, 5 mm. long, acute, very scabrid, the outer ones carinate, denticulate on the keel, oblong-lanceolate, the inner oblong-ovate. Filaments somewhat shorter than the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-lanceolate, the inner

equalling the perianth-segments at the base, trifid, with the middle portion scarcely more than $\frac{1}{3}$ as long as the ovate-triangular base and half as long as the laterals. Style not exerted from the perianth. Valves of the capsule almost circular, c. 4 mm. long. VI.

In dry rocky places.—CAUCASUS: 25 Talysh. Endemic.

172. *A. PSEUDO-AMPELOPRASUM* *Mishchenko ex Grossheim*, Fl. Kavk. I. (1928) 204 et in herb.!

Bulb ovoid, c. 2 cm. thick; outer envelopes . . .; envelopes of the new bulb yellowish; bulblets numerous, elongate, yellowish, shining, smooth. Scape 50-60 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 5, not fistular, linear, canaliculate, smooth, 6-7 mm. wide. Spathe early caducous. Umbel capsuliferous, spherical, dense, many-flowered; pedicels unequal, the inner almost twice as long as the outer, many times longer than the perianth, with few bracts at the base. Segments of the ovoid perianth rosy, with a dirty-purple nerve, 3.5 mm. long, acute, scabrid, the outer ones lanceolate, longer than the oblong-lanceolate outer ones. Filaments almost twice as long as the perianth-segments, connate and adnate to the perianth at the base, slightly ciliate at the base, the outer ones triangular-subulate, the inner trifid, scarcely broader than the perianth-segments at the base, with the middle portion equalling the oblong-triangular base and scarcely longer than the laterals. Style strongly exerted from the perianth. Valves of the capsule broadly elliptic, scarcely emarginate, c. 4 mm. long. VI-VII.

On dry clay slopes.—CAUCASUS: 23 E. Transcauc. Endemic. Descr. from Shorbulag, near Erivan. Type at Leningrad.

173. *A. ATRO-VIOLACEUM* *Boissier*, Diagn. Pl. Or. I, 7 (1846) 112; Boiss. Fl. Or. (1882) 240.—*A. Ampeloprasum* var. *atroviolaceum* Regel in A. H. P. III, 2 (1875) 54; Schmalh. Fl. II (1897) 488.—*A. atroviolaceum* var. *caucasicum* *Sommier et Levier* in A. H. P. XVI (1900) 427.—*A. Ampeloprasum* *auct.*—Exs.: H F R no. 1191; Herb. Fl. As. Med. no. 332.

Bulb ovoid-globose, $1\frac{1}{2}$ - $2\frac{1}{2}$ cm. thick; outer envelopes greyish-brownish, bast-like, obscurely reticulate, surrounding the base of the stem for some distance; envelopes of the new bulb yellowish; bulblets numerous, yellow-brown or yellowish, dull. Scape 60-100 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{2}$ with smooth leaf-sheaths. Leaves 4-5, broadly linear, 2-10 mm. wide, not fistular, scabrid on the margin and keel, narrowed towards the apex, shorter than the scape. Spathe quickly caducous, with a long beak several times exceeding the base of the spathe. Umbel capsuliferous, spherical, many-flowered, dense; pedicels unequal, the inner ones twice as long, 3-6 times as long as the perianth, the outer ones with bracteoles at the base. Segments of the ovoid-campanulate perianth dark-purple-violet, more rarely dirty-greenish, almost equal, 3-4 mm. long, shining, obtuse, the outer ones carinate, \pm scabrid, oblong-ovate, the inner ovate. Filaments $\frac{1}{4}$ - $\frac{1}{3}$ longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base,

the outer ones entire, triangular-subulate, the inner equalling the perianth-segments at the base, trifid, with the middle portion $\frac{1}{3}$ or almost $\frac{1}{2}$ shorter than the laterals. Style exserted from the perianth. Capsule somewhat longer than the perianth. VI-VIII.

In dry places, on rocks, in crops.—EUROPEAN PART: 17 Crimea; CAUCASUS: 20 Ciscauc., 21 Dag., 22 W., 23 E. and 24 S. Transcauc.; C. ASIA: 45 Mountain Turkm., 47 Syr Dar. Gen. distr.: Iran. Descr. from the neighbourhood of the mountains of Shiraz. Cotype at Lenin-grad.

174. *A. LEUCANTHUM* *C. Koch* in *Linnaea* XXII (1849) 240.—*A. Ampeloprasum* var. *leucanthum* Ledebour, *Fl. Ross.* IV (1852) 164; Boiss. *Fl. Or.* V (1882) 232.—*A. firmotunicatum* var. *album* Grossheim in Grossheim et Shishkin, *Sched. Herb. Pl. Or. Exsicc. Fasc. I-VIII* (1924) no. 5.—Exs.: l. c.

Bulb ovoid-spherical, 2-3 cm. thick; outer envelopes greyish-brownish, bast-like; envelopes of the new bulb yellowish; bulblets numerous, yellowish, dull. Scape 50-120 cm. high, clothed for $\frac{1}{4}$ - $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 4-7, broadly linear, not fistular, carinate, 3-9 mm. wide, scabrid, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, almost spherical, dense, many-flowered; pedicels unequal, the inner ones twice as long, 2-8 times as long as the perianth, the outer ones with bracteoles at the base, the inner without bracteoles. Segments of the ovoid-campanulate perianth white with a green nerve, 3-3.5 mm. long, obtuse or subacute, the inner ones elliptic, the outer carinate, scabrid, oblong-ovate. Filaments $\frac{1}{4}$ longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate, the outer ones entire, triangular-subulate, the inner somewhat broader than the perianth-segments at the base, trifid, with the middle portion $\frac{1}{3}$ - $\frac{1}{2}$ shorter than the laterals and $\frac{1}{3}$ - $\frac{1}{2}$ shorter than the ovate-triangular base. Style exserted from the perianth. Capsule slightly longer than the perianth. VI-VII.

In dry places and in crops.—CAUCASUS: 23 E. and 24 S. Transcauc. Endemic (?). Descr. from the Shirvan steppe. Type at Berlin.

NOTE. Very close to *A. atro-violaceum* and deserves further study.

175. *A. AMPELOPRASUM* *Linné*, *Sp. Pl.* (1753) 294; Boiss. *Fl. Or.* V (1882) 232, excl. var. *b.*—*Ic.*: Reichb. *Ic. Fl. Germ.* X (1848) f. 1072.—Exs.: Soc. Etude Fl. Fr.-Helv. no. 1546.

Bulb ovoid-spherical, 2-4 cm. thick; outer envelopes almost papyraceous, slightly fibrous, envelopes of the new bulb yellowish; bulblets numerous, yellowish, finely striate under a lens, \pm dull. Spathe 50-80 cm. high, clothed for $\frac{1}{3}$ with smooth leaf-sheaths. Leaves 6-9, broadly linear, not fistular, 5-10 mm. wide, carinate, smooth, or scabrid on the margin, considerably shorter than the scape. Spathe early caducous. Umbel capsuliferous, spherical, many-flowered, rather lax; pedicels unequal, the central ones twice as long, 4-8 times as long as the perianth, with bracteoles at the base. Segments of the broadly ovoid-campanulate

perianth rosy, c. 5 mm. long, oblong, subacute, scabrid, the outer ones carinate. Filaments scarcely longer than the perianth-segments, connate and adnate to the perianth at the base, ciliate at the base, the outer ones entire, triangular-subulate, the inner equalling the perianth-segments at the base, trifold, with the middle portion half as long as the laterals and the oblong-triangular base. Style exerted from the perianth. Capsule scarcely shorter than the perianth. VI.

A weed.—C. ASIA: 48 Pam.—Al. (foot of Kuh-i-Tang, S. side). Gen. distr.: Atl. Eur., C. Eur., W. Medit., Balkans-Asia Min., Iran. Descr. from the Orient and England.

(176.) A. PORRUM *Linné* Sp. Pl. (1753) 294.—A. *Ampeloprasum* var. *Porrum* Regel in A. H. P. III, 2 (1875) 54; Schmalh. Fl. II (1897) 488.—Ic.: Syreishch. Ill. Fl. Mosc. Gov. I (1906) 237.

Annual. Bulb without or with a few bulblets. Scape arising from the middle of the bulb. Leaves linear-lanceolate. Spathe with a long beak. Umbel large, spherical. Perianth whitish or more rarely rosy, with slightly scabrid segments. Filaments scarcely longer than the perianth, the inner ones trifold with the middle portion half as long as the base. Cultivated plant.

ECONOMIC IMPORTANCE. Grown principally in the European part of the U S S R, for the sake of the whitened bases of the stems, in market-gardens chiefly in the neighbourhood of large towns.

177. A. MONANTHUM *Maximovich* in Bull. Acad. Pétersb. XXXI (1887) 109.—Ic.: Kom. Opred. Rast. Dalnevost. Kraya I (1931) 365, t. 112, f. 3.

Bulb spherical, 0.5-1 cm. thick, with greyish-brownish, almost papyraceous envelopes. Scape 5-15 cm. high, $1/2$ - $2/3$ as long as the leaves, slender, weak, surrounded at the base with membranous sheaths together with leaves. Leaves 1-2, linear, 2-4-8 mm. wide, gradually narrowed towards the base and apex, subacute. Spathe thinly membranous, sometimes coloured, acuminate, somewhat shorter than the umbel. Umbel 1-2-(3)-flowered; pedicels shorter than or equalling the perianth, slightly thickened and expanded beneath the flower. Segments of the broadly campanulate perianth rose-coloured, 4-5 mm. [long], oblong, subobtuse; filaments $1/4$ shorter than the perianth-segments, connate, and adnate to the perianth, for $1/3$, triangular-subulate. Style not exerted from the perianth, stigma trilobed. Ovules 6. IV-V.

Grassy mountain slopes, and in woods.—FAR EAST: 38 Ussuri.—Gen. distr.: Japan-China. Descr. from R. Sidemya. Type at Leningrad.

178. A. PARADOXUM (*Marschall-Bickerstein*) *G. Don*, Mon. (1827) 72; Ledeb. Fl. Ross. IV (1852) 186; Boiss. Fl. Or. V (1882) 257; Schmalh. Fl. II (1897) 481.—*Scilla paradoxa* Marschall-Bickerstein, Fl. Taur.-Cauc. III (1819) 267.—Exs.: Herb. Fl. Cauc. no. 163.

Bulb spherical, c. 1 cm. thick, with grey-black, papyraceous envelopes. Scape sharply triquetrous, 20-30 cm. high, clothed at the base with leafless sheaths besides the leaf. Leaf solitary, linear, 0.5-1-2.5 cm. wide, carinate, gradually narrowed from the middle towards the base,

subacute. Spathe acuminate, approximately $\frac{2}{3}$ as long as the umbel. Umbel 2-5-10-flowered, often with bulbils; pedicels $1\frac{1}{2}$ -2 times as long as the perianth, with nodding flowers. Segments of the broadly campanulate perianth c. 10 mm. long, almost equal, oblong, acute. Filaments $\frac{1}{3}$ as long as the perianth, connate, and adnate to the perianth, for $\frac{1}{4}$, triangular-subulate, almost equal. Style not exerted from the perianth, with a trilobed stigma; ovules 6. Capsule $\frac{1}{2}$ as long as the perianth. V.

In shady woods.—CAUCASUS: 20 Dag., 23 E. Transcauc., 25 Talysh; C. ASIA: 45 Mountain Turkm. (W. Kopet Dag). Gen. distr.: N. Persia. Descr. from Georgia. Type at Leningrad.

179. *A. CANDOLLEANUM* *Albov* in Tr. Tifl. Bot. Sada I (1895) 240.

Bulb almost spherical, 0.75-1.5 cm. wide, with grey papyraceous envelopes. Scape terete, slender, 20-30 cm. high. Leaves 2-3, narrowly linear, 3-7 mm. wide, gradually narrowed towards the base and apex, almost smooth on the margin, acute, somewhat shorter than the scape. Spathe $\frac{2}{3}$ or scarcely more than $\frac{1}{2}$ as long as the umbel, acuminate. Umbel with or without bulbils, fasciculate, few-flowered; pedicels unequal, slightly shorter than or $1\frac{1}{2}$ times as long as the perianth, without bracteoles, with almost cernuous flowers. Segments of the broadly campanulate almost hemispherical perianth white with a rosy tinge, 10-12 mm. long, obtuse, the outer ones elliptic, the inner oblanceolate-elliptic. Filaments scarcely more than $\frac{1}{2}$ as long as the perianth, connate and adnate to the perianth at the base, triangular-subulate, the inner ones $1\frac{1}{2}$ times as broad. Style not exerted from the perianth; ovules 6. VI. (Tab. XV, fig. 2a).

Subalpine and alpine meadows.—CAUCASUS: 22 W. Transcauc. Endemic. Descr. from Mt. Kutysh.

180. *A. OREOPHILUM* *C. A. Meyer*, Verz. Cauc. (1831) 37; Ledeb. Fl. Ross. IV (1852) 188.—*A. platystemon* Karelin et Kirilov in Bull. Soc. Nat. Mosc. XV (1842) 514.—*A. Ostrowskianum* Regel in A. H. P. VII (1881) 545.—*A. oreophilum* var. *Ostrowskianum* Regel in A. H. P. X (1887) 356.—Ic.: Regel in Gartenfl. (1873) t. 775, f. 1-3; [ibid. (1882) t. 1089; Bot. Mag. CXXVII (1901) t. 7756].—Exs.: Herb. Fl. As. Med. no. 62.

Bulb ovoid-spherical, 1-1.5-(2) cm. thick, with grey papyraceous envelopes: Scape 5-20 cm. high, clothed for $\frac{1}{2}$ - $\frac{3}{4}$ with leaf-sheaths which are hidden beneath the ground. Leaves 2, linear, 2-8 mm. wide, scabrid on the margin, considerably longer than the umbel. Spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel, shortly acuminate. Umbel fasciculate or more often hemispherical or spherical, \pm few-flowered, rather lax; pedicels almost equal, half as long as, equalling, or more often slightly longer than, the perianth, without bracteoles at the base. Segments of the broadly campanulate perianth rosy-purple with a darker nerve, 8-11 mm. long, oval, obtuse or more often acute. Filaments $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, connate, and adnate to the perianth, half-way, the outer ones triangular-lanceolate, the inner broadly triangular. Style

not exerted from the perianth, with an almost trilobed stigma; ovules 6. Capsule c. 4 mm. diam. VII-VIII.

Rubbly slopes in the upper mountain zone.—CAUCASUS: 21 Dag.; C. ASIA: 42 Dzung.-Tarb., 48 Pam.-Al., 49 Tien Shan. Endemic. Descr. from Dagestan; Tufan Dag. Type at Leningrad.

181. A. GYPSACEUM *M. Popov et Vvedensky* in Not. Syst. Herb. Horti Bot. Petrop. V (1924) 92.

Bulb ovoid-spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape 7-20 cm. high, clothed up to half-way with leaf-sheaths which are hidden beneath the ground. Leaves 2-3, linear, 2-5 mm. wide, scabrid on the margin, considerably longer than the scape. Spathe slightly shorter or scarcely more than $\frac{1}{2}$ as long as the umbel. Umbel fasciculate-hemispherical, hemispherical or more rarely spherical, \pm few-flowered, dense; pedicels equal, equalling or $1\frac{1}{2}$ -2 times as long as the perianth, without bracteoles at the base. Segments of the campanulate perianth dirty-purple, with a purple nerve, more strongly coloured towards the apex, 10-11 mm. long, the outer ones oblong-linear, acute, slightly longer and broader than the oblanceolate, denticulate, subobtus inner ones. Filaments half as long as the perianth, connate, and adnate to the perianth, up to half-way, scarcely coalescent above this, the outer ones lanceolate-subulate, the inner slightly broader, triangular. Ovary sessile, smooth, with 6 ovules. V-VI. (Tab. XVI, fig. 1a).

Chiefly on outcrops of particoloured rocks.—C. Asia: 48 Pam.-Al. (sporadically in the S. part). Endemic. Descr. from the Kuh-i-Tang Mts.: Khodzha-i-Fil. Type at Tashkent.

182. A. HELICOPHYLLUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb almost spherical, 1.5-2 cm. thick, with papyraceous blackish envelopes. Scape stocky, thick, 5-8 mm. thick, 10-20 cm. high. Leaves 5-6, linear, c. 3 mm. wide, glaucous, glabrous, scabrid on the margin, spirally coiled in the upper third, shorter than the umbel. Spathe $\frac{1}{4}$ as long as the umbel, acuminate. Umbel fasciculate-hemispherical or hemispherical, many-flowered, lax; pedicels unequal, the central ones up to twice as long, many times longer than the perianth (up to 9 cm. long), thick, thickened beneath the flower. Segments of the stellate perianth pale-rose-violet with a strong green or dirty-green nerve, linear-oblong, subobtus, 5 mm. long, reflexed after flowering, \pm revolute. Filaments slightly shorter than the perianth-segments, adnate to the perianth at the extreme base, slightly coalescent with each other above this, subulate from a triangular base, which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary sessile, scabrid, with 6-7 ovules. Capsule spherical, c. 5 mm. diam. V-VI.

Rubbly slopes, outcrops of particoloured rocks. C. ASIA: 45 Mountain Turkm. (Kara Kala, Prokhladnoye, Sulyuklyu). Endemic. Descr. from the neighbourhood of Kara Kala. Type at Tashkent.

183. A. SERGII *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb ovoid, 0.75-1 cm. thick, with grey papyraceous envelopes, covering 1-2 large, yellowish-cinnamomeous, almost smooth, dull bulb-lets. Scape 10-12 cm. high, slender, clothed for $\frac{1}{3}$ - $\frac{1}{2}$ with a leaf-sheath hidden beneath the ground. Leaves usually solitary, very rarely 2, narrowly linear, (1)-2-3-(4) mm. wide, canaliculate, glaucous, twisted like a corkscrew, smooth, or scabrid on the margin, glabrous, equalling the umbel. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel. Umbel generally hemispherical, more rarely fasciculate, few-flowered, lax; pedicels 3-4 times as long as the perianth, without bracteoles at the base, the outer ones slightly ascending. Segments of the stellate perianth pale-rose with a purple nerve, 4 mm. long, lanceolate, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth, connate and adnate to the perianth at the base, equal, subulate from a triangular base. Ovary sessile, papillose [lit. "scabrid"], with 7-9 ovules. V.

Rubbly slopes.—C. ASIA: 49 Tien Shan (Kara Tau). Endemic. Descr. from Uch Uzen. Type at Moscow.

184. A. EUGENII *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 127.

Bulb ovoid, 1-1.5 cm. thick, with grey papyraceous envelopes. Scape clothed almost half-way with 2 sheaths, one of which is leafless. Leaf solitary, linear, 2-7 mm. wide, considerably longer than the umbel, covered in the lower half, beneath, as also the aerial part of the sheath, with reflexed hairs, above and in the anticus half glabrous. Spathe practically without a beak, several times shorter than the umbel. Umbel hemispherical or almost spherical, comparatively few-flowered, lax; pedicels many times longer than the umbel, ascending, without bracteoles at the base. Segments of the stellate perianth rose-coloured with a strong purple nerve, 4 mm. long, linear-oblong, obtuse, later reflexed and twisted. Filaments $\frac{1}{4}$ shorter than the perianth-segments, adnate to the perianth at the base, slightly coalescent with each other above this, subulate from a broadly triangular base which is slightly broader in the inner ones. Ovary almost sessile, scabrid, with 6-7 ovules. Capsule almost spherical, c. 3 mm. in diameter.

Rubbly slopes, at an altitude of 1500-1700 m.—C. ASIA: 45 Mountain Turkm. (Gt. Balkhany). Endemic. Descr. from the Gt. Balkhany Mts.: Kosha Kudzhuk. Type at Leningrad.

185. A. VERTICILLATUM (*Regel*) Regel in A. H. P. VI (1880) 518.—*A. Pallasii* var. *verticillatum* Regel in A. H. P. III (1875) 102.—Exs.: Herb. Fl. As. Med. no. 315.

Bulb ovoid, 0.75-1.5 cm. thick, with greyish papyraceous envelopes. Scape 10-20 cm. high, clothed for $\frac{1}{4}$ with 1 or 2 approximate leaf-sheaths. Leaves shorter than the scape, divided to the sheath into 3-9 filiform, striate, scabrid lobes, simulating a verticil. Spathe with a short beak, slightly shorter than or equalling the umbel. Umbel almost spherical or hemispherical, comparatively many-flowered, lax; pedicels unequal, the central ones sometimes twice as long, 3-7 times as long as the perianth, the outer ones ascending, without bracteoles at the base. Segments of the stellate perianth rosy with a purple nerve, c. 4 mm. long, oblong-

lanceolate, obtuse, later reflexed and twisted. Filaments somewhat longer than the perianth-segments, adnate to the perianth at the base, united above into a ring, subulate from a triangular base. Ovary almost sessile, scabrid, with 8-10 ovules. Capsules spherical, c. 3 mm. in diameter. V-VI. (Tab. XV, fig. 4 a-b).

On earthy and rubble slopes in the foothills and lower mountain zone.—C. ASIA: 48 Pam.-Al. (W. part), 49 Tien Shan (W. and S. W. part). Endemic. Descr. from the Kara Tau Mts. Type at Leningrad.

186. *A. ARIODES* *M. Popov et Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 128.

Bulb ovoid, 1-2 cm. thick, with greyish-brownish, coriaceous, splitting envelopes, covering a solitary, large, shining, yellowish bulblet. Scape c. 20 cm. high, shorter than the leaves. Leaves 2, linear, 0.5-1 cm. wide, scabrid on the margin and on the nerves beneath, withering towards flowering-time. Spathe slightly shorter than or equalling the umbel, with a long herbaceous (especially when young) beak. Umbel hemispherical or spherical, comparatively few-flowered, lax; pedicels almost equal, 3-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth greenish (in the herbarium rosy) with a dirty-purple or dirty-green nerve, c. 4 mm. long, linear-oblong, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth-segments, adnate to the perianth at the base, united above into a ring, subulate from a triangular base which in the inner ones is twice as broad. Ovary almost sessile, with 6-7 ovules. V.

On stony and earthy slopes in the lower mountain zone.—C. ASIA: 48 Pam.-Al. (sporadically in the western part). Endemic. Descr. from the Zeravshan range: Maidan Ata. Type at Tashkent.

NOTE. Well distinguished from species related to *A. verticillatum* by its coriaceous bulb-envelopes, and by the spathe with a long herbaceous beak, recalling in the young state the unopened spathe of Aroids.

187. *A. MONOPHYLLUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 128.

Bulb spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape buried in the ground almost up to the umbel, 5-10 cm. long, considerably shorter than the leaf. Leaf solitary, linear-lanceolate, 3-11 mm. wide, acute, scabrid on the margin. Spathe slightly or $\frac{1}{3}$ shorter than the umbel, shortly acuminate. Umbel hemispherical, \pm few-flowered; pedicels equal, slightly or $1\frac{1}{2}$ -(2) times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth dirty-violet or rose-violet, with a darker nerve, 5-6 mm. long, linear, subobtuse, erect after flowering. Filaments $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate. Capsule (unripe) $\frac{1}{3}$ shorter than the perianth. VII. (Tab. XV, fig. 3 a).

Stony places on the summits of the central Kopet Dag.—C. ASIA: 45 Mountain Turkm. Gen. distr.: N. Iran—Khurasan. Descr. from Iondare. Type at Leningrad.

188. *A. DERDERIANUM* Regel in A. H. P. III, 2 (1875) 242.—*A. haemanthoides* var. *lanceolatum* Boissier, Fl. Or. V (1882) 276.

Bulb almost spherical, 1-1.5 cm. thick, with greyish papyraceous envelopes. Scape thickish, 5-10 cm. high, shorter than the leaves, buried half-way in the ground. Leaves 2, linear-lanceolate, 5-10 mm. wide, scabrid on the margin. Spathe half as long as the umbel, shortly acuminate. Umbel hemispherical or spherical, many-flowered; pedicels almost equal, $1\frac{1}{2}$ (in fruit $2\frac{1}{2}$) times as long as the perianth. Segments of the almost stellate perianth white with a violet nerve, 8-13 mm. long, linear, acute, erect and rigid after flowering. Filaments $\frac{1}{3}$ - $\frac{1}{2}$ as long as the perianth-segments, connate and adnate to the perianth at the base, triangular-subulate. Capsule half as long as the perianth. V.

On dry slopes.—CAUCASUS: 24 S. Transcauc. (?). Gen. distr.: Iran. Descr. from N. Iran. Type at Leningrad.

NOTE. Cited for S. Transcaucasia, but I have seen no specimens thence.

189. *A. ALEXEIANUM* Regel in A. H. P. III, 2 (1875) 244.—Ic.: Regel, Fl. Turk. (1875) t. 16, f. 4-6.

Bulbs almost spherical, 1.5-2 cm. thick, with blackish papyraceous envelopes. Scape thick, 10-20 cm. high, shorter than the leaves, buried half-way in the ground. Leaves (1)-2-3, lanceolate, oblong or elliptic, 2-5 cm. wide. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, shortly acuminate. Umbel hemispherical or more rarely spherical, many-flowered; pedicels unequal, (2)-3-5 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth rose with a purple nerve, 7-8 mm. long, linear-lanceolate, acute, erect and rigid after flowering. Filaments slightly or about $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, the outer ones subulate, the inner $1\frac{1}{2}$ times as broad, triangular-subulate. Capsule scarcely more than $\frac{1}{2}$ as long as the perianth. V-VII.

Rubbly and stony slopes of the middle and upper mountain zones.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from the Zeravshan valley. Type at Leningrad.

190. *A. AKAKA* Gmelin ex Roemer et Schultze, Syst. VII (1830) 1132; Ledeb. Fl. Ross. IV (1852) 187; Boiss. Fl. Or. V (1882) 275.—*A. latifolium* Jaubert et Spach, Ill. Pl. Or. II (1844)⁴⁸ t. 103.

Bulb spherical, 1.5-2.5 cm. thick, with blackish papyraceous envelopes. Scape thick, 5-15 cm. high, shorter than the leaves, buried half-way in the ground. Leaves (1)-2, oblong or elliptic, scabrid on the margin, 2-6 cm. wide. Spathe $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical or hemispherical, many-flowered; pedicels equal, slightly or $1\frac{1}{2}$ times (in fruit 2-3 times) longer than the perianth. Segments of the almost stellate perianth linear, 7-8 mm. long, subacute, rosy with a darker nerve, erect and rigid after flowering. Fila-

⁴⁸ [For dates of publication of Jaubert et Spach, Illust. Pl. Orient. (5 vols., 1842-57), see Stearn in Journ. Soc. Bibl. Nat. Hist. I (1939) 255-259. —W. T. S.]

ments half as long as the perianth-segments, connate and adnate to the perianth at the base, triangular-subulate. Capsule half as long as the perianth. V-VI.

In dry stony places.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Arm.-Kurd., Iran. Descr. from Gilan.

191. *A. MATERCULAE* *Bordzilovsky* in Zap. Kiev. Obsch. Yest. [Mem. Kiev Soc. Nat.] XXV, 1 (1915) 73.

Bulb almost spherical, 1-2 cm. thick, with grey or blackish papyraceous envelopes. Stem thick, 10-30 cm. high, shorter or longer (?) than the leaves, buried in the ground at the base. Leaves 2-4, glaucous, linear-loriform, 1-2 cm. wide, scabrid on the margin. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate, many-flowered; pedicels unequal, 2-8 times as long as the perianth. [Perianth-segments] lilac-coloured with a reddish nerve, 5-9 mm. long, linear, subacute, erect and rigid after flowering. Filaments somewhat shorter than the perianth, connate and adnate to the perianth at the base, triangular-subulate. Capsule scarcely more than half as long as the perianth. IV-V.

In dry places.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Nakhichevan. Type at Kiev.

192. *A. CHRISTOPHI* *Trautvetter* in A. H. P. IX (1884) 268.—*A. albopilosum* C. H. Wright in Gard. Chron. XXXIV (1903) 34.—Ic.: Regel in A. H. P. X (1887) t. 7, f. 1; [Bot. Mag. CXXXI (1904) t. 7982].

Bulb spherical, c. 2 cm. thick, with grey papyraceous envelopes. Scape thick, 5-15 mm. thick, 15-40 cm. high, buried in the ground at the base, approximately equalling the leaves. Leaves 3-7, loriform, 5-25 mm. wide, glaucescent, erect, with stiff spreading hairs beneath and especially on the margin, very rarely almost glabrous. Spathe ($\frac{1}{4}$)- $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical, more rarely spherical, many-flowered, lax; pedicels almost equal, 3-5-several times longer than the perianth-segments, without bracteoles at the base. Segments of the almost stellate perianth purple-violet or rose-violet, 10-15-(18) mm. long, linear-triangular, very acute, erect and rigid after flowering. Filaments half as long as the perianth, connate and adnate to the perianth at the extreme base, equal, abruptly linear-subulate from an expanded base. Capsule c. 5 mm. in diameter. V-VI.

Gentle mountain slopes, principally in the lower zone.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from the neighbourhood of Ashkhabad. Type at Leningrad.

193. *A. BODEANUM* *Regel* in A. H. P. III, 2 (1875) 238.—*A. Walteri* *Regel* in A. H. P. X (1887) 357, t. 7, f. 3.

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape comparatively slender (not more than 5 mm. thick), 10-20 cm. high, buried in the ground at the base, shorter than the leaves. Leaves 1-2-(4), linear-lanceolate, 1-2 cm. wide, recurved, glabrous, scabrid on the margin and sometimes beneath. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate or hemispherical, many-flowered,

lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the almost stellate perianth rose-violet, 10-14 mm. long, linear-triangular, acute, erect after flowering. Filaments almost $\frac{1}{3}$ shorter than the perianth-segments, connate and adnate to the perianth at the extreme base, equal, \pm abruptly linear-subulate from an expanded base. [Ovary . . . ? Style . . . ? Capsule . . . ?] V.

Rubbly and stony slopes of the steppe zone.—C. ASIA: 45 Mount. Turkm. Gen. distr.: Iran. Descr. from Persia. Type at Leningrad.

NOTE. Very close to *A. Christophi* and deserving further study. An *Allium* very close to both species, collected by Chernyakovsky (Seamasur), to which reference is made in the Flora of Turkmenistan (II (1932) 290), still remains obscure.

194. *A. BRACHYSCAPUM* *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 129.—Ic.: Fl. Turkm. II (1932) fig. 104.

Bulb spherical, 1.5-2 cm. thick, with grey papyraceous envelopes. Scape c. 10 cm. high, stocky, buried in the ground half-way or almost to the umbel. Leaves (1)-2, linear-lanceolate or narrowly lanceolate, 1-2 cm. wide, scabrid on the margin, considerably longer than the umbel. Spathe scarcely more than half as long as the umbel, without a beak. Umbel hemispherical, many-flowered, dense; pedicels almost equal, (2)-3-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet with a darker or greenish nerve, 5-6 mm. long, lanceolate, the outer ones subacute, the inner obtuse, later reflexed and twisted. Filaments slightly longer than or $1\frac{1}{2}$ times as long as the perianth-segments, connate, mutually free above, linear-subulate, the inner ones somewhat broader. Ovary on a short stipe, papillose [lit. "Scabrid"]. V.

Rubbly slopes.—C. ASIA: Mountain Turkm. (Sulyuklyu). Endemic. Descr. from Sulyuklu. Type at Tashkent.

195. *A. KARATAVIENSE* *Regel* in A. H. P. III, 2 (1875) 243.—Ic.: Regel, Fl. Turk. (1876) t. 16, f. 1.-3; [Bot. Mag. (1879) t. 6451].—Exs.: Herb. Fl. As. Med. no. 59.

Bulb spherical, 2-6 cm. thick, with blackish or grayish papyraceous envelopes. Scape stocky, 10-25 cm. high, sometimes buried in the ground almost half-way, shorter than the leaves. Leaves generally 2, more rarely 1 or 3, lanceolate or more often oblong or almost elliptic, 3-15 cm. wide, smooth on the margin. Spathe slightly or $\frac{1}{3}$ shorter than the umbel, shortly acuminate. Umbel spherical, many-flowered, dense; pedicels equal, 3-4 times as long as the inflorescence, without bracteoles at the base. Segments of the stellate perianth light-rose-violet with a darker nerve, 5-7 mm. long, linear, obtuse, later reflexed and twisted. Filaments slightly longer than the perianth-segments, adnate to the perianth at the base, coalescent with each other above, subulate from a triangular base which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary on a stipe, papillose [lit. "scabrid"]. Capsule obcordate, c. 8 mm. diam. IV-V.

On mobile limestone screes in the lower mountain zone.—C. ASIA: 48 Pam.—Al. (Alai range), 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the Kara Tau Mts.: Bugun. Type at Leningrad.

196. A. MARIAE *E. Bordzilovsky* in Zap. Kiev. Obshch. Yest. XXV, 1 (1915) 71.

Bulb ovoid, 1.5-2 cm. high. Scape terete, smooth, 15-35 cm. high, surrounded at the base or up to $\frac{1}{3}$ with leaf-sheaths. Leaves 2-3, narrowly linear, 2.5-8 mm. wide, canaliculate, glaucous, scabrid on the margin and often on the nerves beneath, approximately equalling the scape. Spathe acuminate, equalling the umbel or slightly shorter than it. Umbel fasciculate or almost hemispherical; pedicels 2-5 times as long as the perianth, without bracteoles at the base. Segments of the perianth wine-red with a brownish nerve, 3-4 mm. long, linear-oblong, subobtuse or subacute, later reflexed. Filaments slightly longer than the perianth-segments, connate and adnate to the perianth at the base, gradually narrowed from the base to the apex; anthers black-vinaceous. Ovary sessile, smooth; style slightly longer than the stamens. Capsule spherical-ovoid or ovoid. V.

On dry slopes.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Nakhichevan: Chinabad. Type at Kiev.

197. A. CARDIOSTEMON *Fischer* in Ind. Sem. Horti Petrop. VI (1840) 43; Ledeb. Fl. Ross. IV (1852) 188; Boiss. Fl. Or. V (1882) 282.

Bulb ovoid, 0.5-1-2 cm. thick, with blackish papyraceous envelopes. Scape 20-40-(60) cm. high, smooth, clothed at the base with leaf-sheaths. Leaves 2-3, linear-lanceolate or linear, 2-8 mm. wide, \pm scabrid on the margin, shorter (usually considerably) than the scape. Spathe shortly acuminate, slightly or $\frac{1}{3}$ shorter than the umbel. Umbel fasciculate-hemispherical or almost spherical, many-flowered, dense; pedicels equal, 3-4 times as long as the perianth, without bracteoles. Segments of the stellate perianth dark wine-red, c. 3 mm. long, linear, obtuse, later reflexed and twisted. Filaments scarcely shorter than the perianth-segments, connate and adnate to the perianth at the extreme base, the outer ones subulate, the inner considerably broader, obtusely bidentate above the middle. Ovary sessile, smooth. Capsule ovoid or almost spherical, 3-4 mm. long. VI-VII.

On dry slopes.—CAUCASUS: 23 E. and 24 S. Transcauc. Gen. distr.: Iran. Descr. from Nakhichevan: Koshadara. Type at Leningrad.

198. A. FETISOWI *Regel* in A. H. P. V (1878) 631.—*A. simile* Regel in A. H. P. X (1887) 359.—*A. tschimganicum* B. Fedchenko, Rast. [Veg.] Turk. (1915) 237, p. p.—Ic.: Regel, Gartenfl. (1879) t. 971, fig. a-f.

Bulb spherical, 1-1.5 cm. thick, with black papyraceous envelopes. Scape 40-65 cm. high, ribbed owing to the prominent nerves. Leaves 1-2, loriform, 2-15 mm.⁴⁹ wide, smooth or obscurely scabrid on the margin, considerably shorter than the scape; spathe half as long as the umbel, shortly acuminate. Umbel spherical or hemispherical, many-

⁴⁹ ["12-15 m." in the original: presumably mm., not cm., is meant. —Translator's note.]

flowered, dense; pedicels almost equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet, delicate, with an inconspicuous nerve, 5-7 mm. long, linear, obtuse or subobtuse, later reflexed and twisted. Filaments $\frac{1}{4}$ shorter than the perianth-segments, connate and adnate to the perianth at the base, mutually free above, the outer ones subulate from the base, the inner subulate from an almost quadrate 2-4-toothed or more rarely triangular edentate base. Ovary on a short stipes, papillose [lit. "scabrid"]. Capsule ovoid or spherical, c. 4 mm. in diameter. V-VI.

In soft soils.—C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan. Endemic. Descr. from Ama Ata.

NOTE. I have been able to compare living examples of *A. Fetisowi* from Ugam (*A. simile*) and from the neighbourhood of Alma Ata (*A. Fetisowi* s. s.). The Alma Ata plant differs in its slightly smaller flowers, in the considerably narrower perianth-segments, which have a somewhat different tint (they are rose and distinctly purple at the base; in the Ugam plant the perianth-segments are rose-violet), in the rounder ovary and in the darker filaments. Generally speaking the Ugam examples are coarser and larger in all parts, but I have had too little material to be able to treat the characters mentioned as constant.

199. *A. DASYPHYLLUM* Vvedensky in Herb. Fl. As. Med. (1925) no. 57.

Bulb ovoid or spherical-ovoid, 0.75-1.5 cm. thick, with blackish papyraceous envelopes. Scape 15-25-(35) cm. high, ribbed owing to the prominent nerves, scabrid with short hairs. Leaf solitary, linear, 2-3-(5) mm. wide, scabrid with short hairs, distinctly shorter than the scape. Spathe slightly or $\frac{1}{3}$ shorter than the umbel, shortly acuminate. Umbel fasciculate-hemispherical or hemispherical, \pm many-flowered, dense; pedicels equal, $1\frac{1}{2}$ -2 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white, with a strong green nerve, 4 mm. long, linear-lanceolate, acute, later reflexed and twisted. Filaments scarcely longer than the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, the outer ones subulate, the inner 3 times as broad at the base, subulate from an almost quadrate almost bidentate base. Ovary on a short stipes, papillose [lit. "scabrid"]. Capsule almost spherical, 4-5 mm. long. VII.

On stony slopes in the upper mountain zone.—C. ASIA: 49 Tien Shan (known only from the *locus classicus*: Alexander range: Uch Bulak). Type at Tashkent.

200. *A. INSUFFICIENS* Vvedensky in Bull. Univ. As. Centr. 19 (1934) 129.

Bulb almost spherical, 0.75-1.25 cm. thick, with blackish papyraceous envelopes. Scape slender, smooth, 20-30 cm. high. Leaves 3-6, narrowly linear, 1-2 mm. wide, ciliate-scabrid on the margin, considerably shorter than (apparently half as long as) the scape. Spathe shortly acuminate, slightly shorter than the umbel. Umbel fasciculate-spherical or hemi-

spherical, fairly multiflorous, dense; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth apparently rose-violet with a darker nerve, 4-5 mm. long, linear, obtuse, later reflexed and twisted. Filaments approximately equalling the perianth-segments, adnate to the perianth at the extreme base, mutually free above, abruptly subulate from a broadly triangular base, almost equal. Ovary sessile, smooth. Capsule almost spherical, c. 3.5 mm. in diameter. IV-V.

On argillaceous, slightly saline soils. C. ASIA: 48 Pam.-Al. (Kurgan Tyube, Tash Bulak, Sarsaryak). Endemic. Descr. from the neighbourhood of Kurgan Tyube. Type at Leningrad.

201. *A. ROBUSTUM* *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XIV (1841) 853.—*A. robustum* var. *alpestre* *Karelin et Kirilov* in Bull. Soc. Nat. Mosc. XV (1842) 513.

Bulb almost spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape 40-60 cm. high, with feebly projecting nerves. Leaves 2-4, linear, 2-10 mm. wide, smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, slightly or 1/3 shorter than the umbel. Umbel hemispherical or almost spherical, many-flowered, dense; pedicels equal, 1½-2-(3) times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-purple with a darker nerve, c. 5 mm. long, linear-lanceolate, obtuse, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base which in the inner ones is almost twice as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule ovoid-spherical, c. 4 mm. in diameter. V-VI.

On dry slopes.—C. ASIA: 42 Dzung.-Tarb. Endemic. Descr. from the Tarbagatai: Chegarak Asu. Type at Leningrad.

202. *A. DECIPIENS* *Fischer ex Roemer et Schultes* Syst. VII (1830) 1117; Boiss. Fl. Or. V (1882) 282; Schmalh. Fl. II (1897) 491; Kryl. Fl. Zap. Sib. III (1929) 632.—*A. tulipifolium* *Ledebour* Ic Pl. Fl. Ross. II (1830), 13, t. 137; *Ledeb.* Fl. Ross. IV (1852) 187.—*A. viridulum* *Ledebour*, Fl. Alt. II (1830) 20, pro max. parte, quoad specimina authentica.—*A. Roborowskianum* *Regel* in A. H. P. X (1887) 359, t. 7, f. 4.—*A. atropurpureum* auct.

Bulb spherical-ovoid or spherical, 0.75-1.5-2 cm. thick, with blackish papyraceous envelopes. Scape 20-50-(70) cm. high, smooth. Leaves 2-4-(6), linear or linear-lanceolate, (2)-5-20-(30) mm. wide, smooth or scabrid on the margin, considerably shorter than the scape. Spathe shortly acuminate, 1/3-1/2 as long as the umbel. Umbel fasciculate-hemispherical, hemispherical or almost spherical, many-flowered, rather lax; pedicels equal, 2-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth pale-rosy-violet or violet (?) with a violet nerve, c. 5 mm. long, narrowly elliptic, obtuse, later reflexed and twisting. Filaments equalling the perianth-segments, adnate to the perianth at the base, slightly coalescent above, subulate from

a triangular base which in the inner ones is twice as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule ovoid, c. 5 mm. in diameter. V-VI.

On stony slopes, bare places, salt-marshes, sands.—EUROPEAN PART: 13 Volga-Don, 14 Transvolga, 16 Black Sea, 17 Crimea, 18 Lower Don, 19 Lower Volga; CAUCASUS: 20 Ciscauc.; W. SIBERIA: 27 Upper Tob., 28 Irt., 29 Alt.; C. ASIA: 40 Aral-Casp., 41 Balkhash. Gen. distr.: Dzung-Kashg. Descr. from the region between the Dnepr and the Crimea.

203. A. SEWERZOWI *Regel* in Bull. Soc. Nat. Mosc. XLI, 1 (1867) 453.—*A. tschimganicum* B. Fedchenko, Rast. Turk. (1915) 237, p. p.—Exs.: Herb. Fl. As. Med. no. 342.

Bulb spherical, 1-2 cm. thick, with greyish papyraceous envelopes. Scape 35-85 cm. high, striate owing to the prominent nerves. Leaves (1)-2-3, linear or linear-lanceolate, 5-20 mm. wide, scabrid on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel hemispherical or more rarely spherical, many-flowered, \pm dense; pedicels almost equal, $1\frac{1}{2}$ -2 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-coloured with a violet nerve, c. 4 mm. long, linear, sub-obtuse, later reflexed and twisted. Filaments slightly shorter than or equalling the perianth-segments, adnate to the perianth at the base, mutually almost free above, subulate from a triangular base which in the inner ones is 2-3 times as broad. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule almost spherical or ovoid, c. 4 mm. wide. VI.

On rubbly slopes.—C. ASIA: 49 Tien Shan (W. Tien Shan). Endemic. Descr. from the Kara Tau Mts.: Boroldai. Type at Leningrad.

204. SUWOROWI *Regel*,⁵⁰ Gartenfl. (1881) 356, t. 1062, f. 4-5.—Ic.: *Regel*, Fl. Turk. (1876) t. 17, f. 5-7; [Bot. Mag. CXIV (1888) t. 6994.]—Exs.: Herb. Fl. As. Med. no. 181, sub. *A. Severtzovii*.

Bulb spherical, 2-3 cm. in diameter, with almost coriaceous, greyish, splitting envelopes, surrounding the base of the stem. Scape 30-100 cm. high, with feebly projecting nerves. Leaves 2-6, loriform, 5-20 mm. wide, scabrid on the margin, glaucescent, considerably shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ shorter than the umbel. Umbel hemispherical or spherical, many-flowered, dense; pedicels equal, 2-5 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth rose-violet with a darker nerve, c. 4 mm. long, linear, obtuse, later reflexed and twisted. Filaments slightly shorter or slightly longer than the perianth-segments, adnate to the perianth at the base,

⁵⁰ [The resemblance between this species and *A. Sewerzowi* is so close that Lipsky united them (cf. A. H. P. XVIII (1900) 139), overlooking differences in the form of the stamens and the surface of the ovary, as well as in ecological preferences to which Vvedensky later called attention when restoring *A. Suworowi* to specific rank (cf. Sched. Herb. Fl. Asiae Med. no. 181; Bull. Univ. Asie Centr. XII (1926) Suppl. 6). Vvedensky takes the type locality of *A. Suworowi* to be the Dalverzin steppe near Uralskaya south of Tashkent. —W. T. S.]

mutually free above, subulate from a somewhat expanded base, almost equal. Ovary almost sessile, smooth. Capsule broadly ovoid, c. 5 mm. in diameter. V.

On soft soils in foothills, chiefly as a weed in oases.—C. ASIA: 45 Mountain Turkm. (Kushkin region), 47 Syr Dar., 48 Pam.—Al., 49 Tien Shan. Gen. distr.: Iran (?).⁵¹ Descr. from the Dalverzin steppe.

205. A. GRANDE *Lipsky* in A. H. P. XIII (1894) 343.—*A. decipiens* var. *latissimum* *Lipsky* in Zap. Kiev. Obshch. Yest. XII, 2 (1892) 363; Schmalh. Fl. II (1897) 491.

Bulb ovoid-spherical, 2.5 cm. wide. Scape 70 cm. high (and more), with feebly projecting nerves. Leaves 2-4, loriform, 3-5 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe slightly shorter than, or scarcely more than half as long as, the umbel, shortly acuminate. Umbel almost spherical, many-flowered, dense; pedicels almost equal, 3-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white-rose, with an inconspicuous nerve, lanceolate, acute, 6-7 mm. long, reflexed after flowering. Filaments scarcely shorter than the perianth-segments, adnate to the perianth at the base, mutually free above, subulate from a triangular base which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary on a short stipe, smooth. V.

In damp places among bushes.—CAUCASUS: 21 Dag. Endemic. Descr. from Makhach Kal. Type at Leningrad.

206. A. ALAICUM *Vvedensky* in Bull. Univ. As. Centr. 19 (1934) 130.

Bulb ovoid-spherical, 1-1.5 cm. thick, with blackish-grey, papyraceous, somewhat splitting envelopes. Scape 30-70 cm. high, ribbed owing to the prominent nerves, glabrous or with long deflexed hairs. Leaves 1-2, linear-lanceolate or linear, 5-17 mm. wide, acute, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the scape, with long reflexed hairs on both surfaces, sometimes almost shaggy, more rarely almost glabrous. Spathe shortly acuminate, $\frac{2}{5}$ - $\frac{1}{2}$ as long as the umbel. Umbel fasciculate-hemispherical, more rarely spherical, many-flowered, \pm lax; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth apparently light-violet with a darker nerve, 6mm. long, linear, subobtuse, later reflexed and twisted. Filaments approximately equaling the perianth-segments, adnate to the perianth at the extreme base, mutually free, abruptly subulate from a short expanded base, which is $1\frac{1}{2}$ times as broad in the inner ones. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule ovoid-spherical, c. 4 mm. in diameter. V-VI. (Tab. XV, fig. 1a).

On rubbly soils.—C. ASIA: 48 Pam.-Al. (Gulcha, Araban, Lyan-gar). Endemic. Descr. from Gulcha. Type at Leningrad.

⁵¹ [A specimen referred to *A. Suworowi* Regel, collected in North Iraq ("Kurdistaniae Turicae distr. Serizor") near Erbil, east of Mosul, is illustrated in Nábělek, Iter Turcico-Persicum IV (1929) fig. 7 and t.l, in Publ. Fac. Sci. Univ. Masaryk, 105 (1929). —W. T. S.]

207. *A. STIPITATUM* *Regel* in *Gartenfl.* (1881) 355, t. 1062, f. 1-3.

Bulb depressed-spherical, 3-6 cm. thick, with blackish almost papyraceous envelopes, covering a single, large, smooth bulblet. Scape 60-150 cm. high, smooth. Leaves 4-6, loriform, 2-4 cm. wide, smooth on the margin, hairy beneath, more rarely almost glabrous. [Umbel . . . ?]; pedicels almost equal, 3-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth lilac with a conspicuous nerve, 9 mm. long, gradually narrowed from the base, acute, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, \pm gradually subulate from a triangular base, which in the inner ones is twice as broad. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule depressed-globose, c. 5 mm. in diameter. V-VI.

On gentle slopes in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. Endemic.⁵² Descr. from the Zeravshan valley. Type at Leningrad.

208. *A. GULCZENSE* *B. Fedchenko* [in *Journ. Bot. Soc. Nat. St. Petersb.* (1906) 194, reimpr. in *Fedde, Rep. Sp. Nov.* IV (1907) 320, et] in *A.H.P.* XXVIII (1908) 68.

Bulb ovoid-spherical, 3-5 cm. thick, with blackish papyraceous envelopes. Stem robust, 90-150 cm. high, smooth. Leaves 5-6, loriform, 4-8 cm. wide, smooth on the margin, considerably shorter than the stem. Spathe shortly acuminate, $\frac{1}{3}$ shorter than the umbel. Umbel spherical, many-flowered, dense; pedicels unequal, the inner ones $1\frac{1}{2}$ times the longer, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth white with a green nerve, 11 mm. long, filiform-linear, gradually narrowed from the base to the apex, later reflexed and twisted. Filaments slightly shorter than the perianth-segments, adnate to the perianth at the base, mutually almost free, the outer ones subulate, the inner $1\frac{1}{2}$ times as broad, subulate from an almost quadrate bidentate base. Ovary sessile, papillose [lit. "scabrid"]. Capsule spherical, c. 6 mm. in diameter. V-VI.

On dry slopes in the intermediate mountain zone. C. ASIA: 48 Pam.-Al. (Alai range), 49 Tien Shan (Fergana range). Endemic. Descr. from the Alai range: Gulcha. Type at Leningrad.

209. *A. AFLATUNENSE* *B. Fedchenko* in *Bull. Herb. Boiss.* IV (1904) 917, cum tabula.

Bulb ovoid, 2-6 cm. thick, with greyish papyraceous envelopes. Scape robust, 80-150 cm. high, with feebly projecting nerves, surrounded by leaf-sheaths at the base both below and above the ground. Leaves

⁵² [If *A. birtifolium* Boissier (1882) proves conspecific with *A. stipitatum* Regel (1881), as seems probably—Lipsky united them in 1900 (*A. H. P.* XVIII. 138)—then *A. stipitatum* is not an endemic of the Pamir-Alai region but occurs also in Western Persia, in the Bakhtiari country (described by J. V. Harrison in *Geogr. Journ.* LXXX (1932) 193-210) between Isfahan and Dizful, as well as in the Elwend mountains near Hamadan further north. —*W. T. S.*]

6-8, loriform, the outer ones 2-10 cm. wide, glaucous, smooth on the margin, considerably shorter than the scape. Spathe slightly shorter than the umbel, shortly acuminate. Umbel almost spherical, dense, many-flowered; pedicels almost equal, 2-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth light-violet with a darker nerve, 7-8 mm. long, linear-lanceolate, acute, later reflexed and twisted. Filaments slightly longer than the perianth-segments, adnate to the perianth at the base, mutually free above, the outer ones subulate, the inner subulate from an almost quadrate base which is $1\frac{1}{2}$ times or almost twice as broad; anthers violet. Ovary on a stipe, papillose [lit. "scabrid"]. Capsule broadly ovoid, almost spherical, c. 5 mm. in diameter. V.

In the upper and intermediate mountain zones.—C. ASIA: 49 Tien Shan (C. Tien Shan). Endemic. Descr. from Aflatun. Type at Leningrad.

210. *A. ALTISSIMUM* Regel in A.H.P. VIII (1884) 666, t. 21, f. k-m. —*A. jesdianum* Vvedensky in Fl. Turkm. II (1932) 282 [non Boiss. et Buhse].^{52a}

Bulb spherical, 3 cm. thick, with greyish papyraceous envelopes. Scape 80-150 cm. high, with feebly projecting nerves. Leaves 4-6, linear-lanceolate, almost loriform, 2-4 cm. wide, \pm green, almost smooth on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel spherical, many-flowered, dense; pedicels unequal, the central up to $1\frac{1}{2}$ times as long, 4-6 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth violet, with a darker nerve, 6-7-(8) mm. long, linear-lanceolate, obtuse, later reflexed and twisted. Filaments equalling or slightly shorter than the perianth-segments, adnate to the perianth at the base, mutually \pm coalescent above, subulate from a triangular base which in the inner ones is twice as broad; anthers yellow. Ovary on a short stipe, papillose [lit. "scabrid"]. Capsule obovoid, c. 5 mm. in diameter. IV.

In gorges.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. Endemic. Descr. from Baldzhuan. Type at Leningrad.

Note. I have been unable to find, from herbarium material, any essential differences between the Kopet Dag and Pamir-Alai plants; on the other hand all this material that I have examined differs from the type in the narrower and slightly shorter perianth-segments. A comparison of the Fergana and Kopet Dag plants in the living state is necessary.

From *A. jesdianum* Boiss. et Buhse our plants differ in the perianth-segments having parallel margins and in the feeble ribbing of the stem.

211. *A. TAENIOPETALUM* M. Popov et Vvedensky in Bull. Univ. As. Centr. 19 (1934) 130.

^{52a} [To the synonymy of *A. altissimum* can be added *A. jesdianum* var. *latipetalum* Lipsky in A. H. P. XVIII (1900) 145. —W. T. S.]

Bulb almost spherical, 1-2 cm. thick. Scape 20-40 cm. high, ribbed owing to the prominent nerves. Leaves 2-3, almost loriform, 1-2 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe half as long as the umbel, shortly acuminate. Umbel fasciculate-hemispherical or spherical, \pm many-flowered; lax; pedicels unequal, the inner ones $1\frac{1}{2}$ times as long, 2-4 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth deep rose-violet, with a greenish nerve, 8-12 mm. long, linear, with almost parallel margins, obtuse, later reflexed and twisted. Filaments $\frac{1}{3}$ shorter than the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base, the inner ones slightly broader, anthers violet. Ovary almost sessile, scabrid. Capsule ovoid or almost spherical, c. 5 mm. in diameter. V.

In the shade of rocks.—C. ASIA: 48 Pam.-Al. (Turkestan range). Descr. from Zera Bulak heights. Type at Leningrad.

Note. Very close to *A. Rosenbachianum* Regel, from which, however, it is easily distinguished by the parallel margins of the perianth-segments and the shorter filaments.

212. *A. ROSENBACHIANUM* Regel in A.H.P. VIII (1884) 664, t. 21, f. c.-i.

Bulb spherical, 1.5-2.5 cm. thick, with blackish papyraceous envelopes. Scape 50-70 cm. high, ribbed owing to the prominent nerves. Leaves 2-3, linear-lanceolate or broadly linear, (0.5)-1-5 cm. wide, almost smooth on the margin, considerably shorter than the scape. Spathe shortly acuminate, $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel. Umbel spherical, many-flowered, lax; pedicels unequal, the central ones up to $1\frac{1}{2}$ times as long, 3-9 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-violet with a darker nerve, narrowly linear, gradually narrowed from the base, acute, 7-10 mm. long, later reflexed and twisted. Filaments equalling the perianth-segments, adnate to the perianth at the base, coalescent into a ring above, subulate from a triangular base, the inner ones twice as broad; anthers violet. Ovary on a short stipe, scabrid. Capsule depressed-spherical, c. 5 mm. in diameter. V.

On islands of earth in the intermediate mountain zone, in the shade of rocks and trees.—C. ASIA: 48 Pam.-Al. (S. W. part). Endemic. Descr. from Baldzhuan: Kyzyl Su. Type at Leningrad.

213. *A. KOMAROVII* Lipsky in A.H.P. XVIII (1900) 129.

Bulb spherical, 2-4 cm. wide. Scape 30-50 cm. high, almost without prominent nerves. Leaves 1-2, broadly lanceolate or oblong, 4-8 cm. wide, smooth on the margin, subacute, considerably shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ shorter than the umbel. Umbel hemispherical, many-flowered, dense; pedicels equal, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth dark-lilac with a darker nerve, linear-lanceolate, c. 6 mm. long, subobtuse, later reflexed and twisted. Filaments slightly longer than the perianth, adnate to the perianth at the base, coalescent into a ring above, \pm gradually subulate from a triangular base, which in the inner

ones is twice as broad. Ovary on a short stipe. Capsule almost spherical, c. 6 mm. in diameter. V-VI.

Screes in the upper mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Iskander Kul. Type at Leningrad.

214. *A. SARAWSCHANICUM* Regel in A.H.P. III, 2 (1875) 244.—Ic.: Regel, Fl. Turk. (1876) t. 17, f. 1-4.

Bulb spherical, (1)-1.5-2 cm. in diameter, with grey papyraceous envelopes sometimes concealing a single large bulblet. Scape 25-50 cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear-lanceolate, 1-4 cm. wide, scabrid or smooth on the margin, shorter than the scape. Spathe shortly acuminate, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the umbel. Umbel spherical or almost spherical, many-flowered, rather lax; pedicels unequal, the central ones slightly longer than the perianth, without bracteoles at the base. Segments of the stellate perianth deep rose-violet, with a darker nerve, 6-7 mm. long, linear, gradually narrowed from the base [? sic!], acute, later reflexed and twisted. Filaments slightly shorter than the perianth, subulate, adnate to the perianth at the base, coalescent into a ring above, provided with small teeth in the spaces between the filaments. Ovary on a short stipes, smooth, with 6 cornicles. Capsule almost spherical, c. 4 mm. in diameter. V.

In shady places in the intermediate mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Zeravshan. Type at Leningrad.

215. *A. PSEUDO-SERAVSCHANICUM* M. Popov et Vvedensky in Sched. ad Herb. Fl. As. Med. (1935) no. 621.

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape (20)-30-50-(70) cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear-lanceolate, 1-4 mm. wide, scabrid on the margin, considerably shorter than the scape. Spathe slightly or $\frac{1}{3}$ shorter than the umbel, shortly acuminate. Umbel spherical or almost spherical, many-flowered, dense; pedicels unequal, the central ones slightly longer, 2-3 times as long as the perianth, without bracteoles at the base. Segments of the stellate perianth light-rose-violet, with a darker nerve, 6-8 mm. long, linear, gradually narrowed from the middle, acute, later reflexed and twisted. Filaments slightly shorter than the perianth-segments, subulate, adnate to the perianth at the base, coalescent above into an entire-margined ring. Ovary on a short stipes, smooth, with 6 cornicles. Capsule almost spherical, c. 4 mm. in diameter. V-VI.

In shady places.—C. ASIA: 45 Mountain Turkm. Endemic. Descr. from Syunt. Type at Leningrad.

Note. Very close to *A. sarawschanicum* Regel, but distinguished by its lighter flowers and more compressed umbel. Requires further study.

216. *A. ELATUM* Regel in A.H.P. VIII (1884) 665, t. 20, f.g.k.—*A. isphairamicum* B. Fedchenko [in Journ. Bot. Soc. Nat. St. Petersburg. (1906) 194, reimpr. in Fedde, Report Sp. Nov. IV (1907) 320, et] in A.H.P. XXVIII (1908) 67.

Bulb ovoid-spherical, 2-6 cm. thick, with blackish papyraceous envelopes. Scape 60-100 cm. high, ribbed owing to the \pm prominent nerves. Leaves 2-14, oblanceolate, 2-7 cm. wide, smooth on the margin. Spathe $\frac{1}{3}$ shorter than the umbel. Umbel spherical, many-flowered, dense; pedicels equal, 3-8 times as long as the perianth, without bracteoles. Segments of the stellate perianth bright violet, with an inconspicuous darker nerve, 6-8 mm. long, linear-lanceolate, subacute or obtuse, unchanged after flowering. Filaments slightly longer than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary sessile, papillose [lit. "scabrid"]. VI-VII.

On stony slopes in the upper mountain zone.—C. ASIA: 48 Pam.-Al. Endemic. Descr. from Baldzhuan.

217. *A. GIGANTEUM* Regel in Gartenfl. (1883) 97, t. 1113.—*A. procerum* Trautvetter in A.H.P. IX (1884) 274.—[lc. Gartenfl. l. c.; A.H.P. VIII (1883) 663, t. 20, fig. h, 21, fig. m; Bot. Mag. CXI (1885) t. 6828].

Bulb ovoid, 4-6 cm. thick, with fairly numerous, grey-brown, coriaceous, splitting envelopes. Scape robust, 80-150 cm. high, with feebly projecting nerves. Leaves loriform, glaucous, 5-10 cm. wide, smooth, $\frac{1}{3}$ - $\frac{1}{2}$ as long as the scape. Spathe $\frac{1}{2}$ as long as the umbel, with a short beak. Umbel spherical, many-flowered, dense; pedicels almost equal, 5 to many times longer than the umbel, without bracteoles. Segments of the stellate perianth light-violet, with an inconspicuous nerve, 5 mm. long, elliptic, obtuse, unchanged after flowering. Filaments almost $1\frac{1}{2}$ times as long as the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary almost sessile, papillose [lit. "scabrid"]. Capsule almost spherical, c. 4 mm. in diameter. IV-V.

Gentle slopes in the lower mountain zone.—C. ASIA: 45 Mountain Turkm., 48 Pam.-Al. (S. part). Gen. distr.: Iran. Descr. from the neighbourhood of Merv (?).⁵³ Type at Leningrad.

218. *A. TRAUTVETTERIANUM* Regel in A.H.P. VIII (1884) 661, t. 21, f. a-b.

Bulb ovoid-spherical, 2-3 cm. thick, with greyish almost papyraceous envelopes. Scape 50-60 cm. high, ribbed owing to the prominent nerves. Leaves 2, lanceolate, 2-3 cm. wide, smooth on the margin, considerably shorter than the scape. Spathe $\frac{1}{2}$ - $\frac{2}{3}$ as long as the umbel. Umbel

⁵³ [Although Baker and Regel state that Merv was the locality from which E. O'Donovan (1844-83), a British war-correspondent, introduced *Allium giganteum* into cultivation, it is more likely that O'Donovan collected it in the mountains between Merv and Meshed, in adjacent Persia, on his release from detention in the Marv oasis. At a place in the mountains between Meshed and Chacha he recorded that "the ground around us produced an abundance of wild flowers, among them a peculiar alium, the flower stalk of which grew to a height of four feet and was known to the Turcomans by the name of the *deli guzella*" (O'Donovan, The Merv-Oasis, II (1882) 454). It was probably here that he collected the bulbs given to Miles. —W. T. S.]

spherical, dense, many-flowered; pedicels equal, 3-5 times as long as the perianth, immersed at the base in the thickened spongy apex of the stem, without bracteoles. Segments of the stellate perianth light-violet (?), with an inconspicuous nerve, 7-10 mm. long, elliptic, obtuse, almost coriaceous after flowering. Filaments slightly shorter than the perianth-segments, connate and adnate to the perianth at the base, subulate from a triangular base which in the inner ones is $1\frac{1}{2}$ times as broad. Ovary on a short stipes, papillose, [lit. "scabrid"]. V.

On outcrops of particoloured rocks (?).—C. ASIA: 48 Pam.-Al. (Ak Su, Tut Kaul). Endemic. Descr. from Baldzhuan. Type at Leningrad.

219. A. SCHUBERTII *Zuccarini* in Abh. Munch. Acad. III (1843) 234, t. 3, f. 1; Boiss. Fl. Or. V (1882) 278.—*A. bucharicum* Regel in A.H.P. VIII (1884) 660, t. 20, f. a-c. [lc. Bot. Mag. CXXIV (1898) tt. 7587-8].—Exs. HFAM no. 64.

Bulb spherical, 2-3 cm. thick, with blackish papyraceous envelopes. Scape stocky, 10-30 cm. high. Leaves linear-lanceolate, 6-30 mm. wide, crisped, glaucous, scabrid on the margin, somewhat longer than the scape. Spathe many times shorter than the umbel, with a very short beak. Umbel spherical, more rarely hemispherical, many-flowered, very lax; pedicels usually very unequal, the fertile ones 1-10 cm., the sterile 2-20 cm. long, clavately thickened beneath the flower, especially in fruit, without bracteoles. Segments of the almost stellate perianth whitish or rosy, with a green or dirty-purple nerve, 4-8 mm. long, linear-lanceolate or lanceolate, obtuse or subobtuse, rigid after flowering, pointing obliquely upwards. Filaments in the sterile flowers $\frac{1}{2}$ - $\frac{2}{3}$ as long as the perianth-segments, in the fertile ones equalling them or $\frac{1}{3}$ shorter, connate and adnate to the perianth for $\frac{1}{2}$ - $\frac{1}{3}$ ⁵⁴ [*sic*] in the sterile ones, for $\frac{1}{6}$ in the fertile ones, subulate from expanded almost equal bases. Ovary almost sessile. Capsule c. 4 mm. long. V-VI (Tab. XVI, fig. 2a).

Rubby slopes of the lower mountain zone, and sands.—C. ASIA: 40 Aral Casp., 41 Balkhash, 43 Kyzyl Kum, 48 Pam.-Al., 49 Tien Shan. Gen. distr.: E. Medit. Descr. from Palestine.

220. A. CASPIUM (*Pallas*) *Marschall-Bieberstein*, Fl. Taur.-Cauc. I (1808) 265; Ledeb. Fl. Ross. IV (1852) 186; Schmalh. Fl. II (1897) 491.—*Crinum caspium* Pallas, Reise . . . II (1773) 736, t. Q.—*Amaryllis caspia* Willdenow, Sp. Pl. II (1799) 62.—*A. baissunense* Lipsky in A.H.P. XVIII (1900) 140.—Ic.: [Bot. Mag. LXXVII (1851) t. 4598]; Fl. Yugo-vost. III (1929) fig. 183.—Exs.: HFAM no. 333.

Bulb spherical, 2-4.5 mm. in diameter, with papyraceous almost black envelopes. Scape more often stocky, 10-30 cm. high. Leaves 1-3, linear or linear-lanceolate to broadly lanceolate, 5-25 mm. wide, scabrid or smooth on the cartilaginous margin, not exceeding the scape. Spathe $\frac{1}{3}$ as long as the umbel. Umbel fasciculate, more often hemispherical or spherical, many-flowered, comparatively lax; pedicels 2-4 (and more)

⁵⁴ [$\frac{1}{2}$ - $\frac{2}{3}$ may be intended. —Translator's note.]

times as long as the perianth-segments (up to 15 cm. long), without bracteoles at the base. Segments of the campanulate perianth dirty-greenish-violet or more rarely whitish, 5-11 mm. long, oblong or oblong-oval, more rarely lanceolate, obtuse, the inner ones sometimes denticulate, up to $1\frac{1}{2}$ times as broad as the outer, unchanged after flowering. Filaments violet or more rarely white, $1\frac{1}{2}$ -2 times as long as the perianth-segments, edentate, connate and adnate to the perianth at the base, almost equal, linear-subulate from an expanded base. Ovary smooth, on a short stipe. Capsule broadly obovoid, c. 4 mm. in diameter.

In sandy deserts and on sands in the regions of outcrops of parti-coloured rocks.—EUROPEAN PART: 19 Lower Volga; CAUCASUS: 20 Ciscauc., 21 Dag.; C. ASIA: 40 Aral-Casp., 43 Kyzyl Kum, 44 Kara Kum, 45 Mountain Turkm. (Kushkin region), 47 Syr. Dar., 46 Amu Dar., 48 Pam.-Al. (S. W. part). Endemic. Descr. from the Caspian desert.

NOTE. It is very possible that *A. baissunense* Lipsky can be distinguished as a white-flowered, local race, of very limited distribution, but this point requires further observation in the field.

221. *A. DARWASICUM* Regel in A. H. P. VIII (1884) 659, tab. VII, f. a-e.

Bulb spherical, 1-2 cm. thick, with greyish papyraceous envelopes. Scape (10)-20-30-(50) cm. high, ribbed owing to the prominent nerves. Leaves 1-2, linear or narrowly linear, 4-20 mm. wide, \pm scabrid on the margin, slightly shorter or slightly longer than the scape. Spathe acuminate, slightly or $\frac{1}{3}$ shorter than the umbel. Umbel fasciculate-hemispherical or hemispherical, \pm many-flowered, dense; pedicels equal, slightly shorter than or up to $1\frac{1}{2}$ times as long as the perianth, without bracteoles. Segments of the narrowly campanulate perianth white with a greenish nerve, 8-11 mm. long, linear-oblong, generally acute, the outer ones $1\frac{1}{2}$ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{3}{5}$ - $\frac{2}{3}$, almost free above, triangular, the inner ones 3 times as broad as, and slightly longer than, the outer. Ovary on a short stipes. Capsule almost spherical, c. 5 mm. in diameter. VI-VII.

On gentle slopes in the intermediate and upper mountain zones.—C. ASIA: 48 Pam.—Al. (S. E. part). Endemic. Descr. from Darvaz: Kuh-i-Frush. Type at Leningrad.

222. *A. WINKLERIANUM* Regel in A. H. P. VIII (1884) 661; Regel in A. H. P. X. (1887) 354.

Bulb spherical, 0.75-2 cm. thick, with blackish generally papyraceous envelopes. Scape 15-40-(100) cm. high, ribbed owing to the prominent nerves. Leaves 1-2-(4), linear or narrowly linear-lanceolate, 5-25 mm. wide, smooth, or scabrid on the margin and on the nerves beneath, shorter than the scape. Spathe acuminate, slightly shorter than or half as long as the umbel. Umbel fasciculate-hemispherical or hemispherical, many-flowered, dense; pedicels generally equal, slightly shorter than or $1\frac{1}{2}$ times (to twice) as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-violet with

a darker nerve, 7-10-(13) mm. long, linear-oblong, generally obtuse, the outer ones $1\frac{1}{2}$ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $1/2$ - $2/3$, almost free above, triangular, [the inner ones?] twice as broad as and slightly longer than the outer. Ovary on a short stipes. Capsule almost spherical, c. 5 mm. in diameter. V-VII. (Tab. XVI, fig. 3a).

Gentle slopes in the intermediate and upper mountain zones.—C. ASIA: 48 Pam.-Al., 49 Tien Shan (Fergana range). Gen. distr.: Dzung.-Kashg. Descr. from "Western Turkestan." Type at Leningrad.

NOTE. A polymorphic species, deserving, like *A. darwasicum*, further study. Especially aberrant are the specimens collected by Lipsky on the Sary Socho pass. They have very unequal pedicels (up to 5 cm.) and filaments adnate to the perianth somewhat higher up.

223. *A. CUPULIFERUM* Regel in A. H. P. III, 2 (1875) 234.—Ic.: Regel, Fl. Turk. (1876) t. 15, f. 4-5.

Bulb spherical, 1.5-2 cm. thick, with blackish papyraceous envelopes, covering (always ?) a large, yellowish, shining, finely-nerved bulblet. Scape 30-50 cm. high, with \pm prominent nerves. Leaves 1-3, linear-lanceolate or lanceolate, 5-30 mm. wide, scabrid or smooth on the margin, considerably (up to twice) shorter than the scape. Spathe shortly acuminate, several times shorter than the umbel. Umbel fasciculate or hemispherical, few-flowered, very lax; pedicels unequal, 2-6 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-violet with a darker nerve, 10-15 mm. long, linear-oblong, obtuse, the outer ones $1\frac{1}{2}$ times as broad, withering after flowering. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $2/3$, connate above this for $1/3$, triangular, the inner ones $1\frac{1}{2}$ times as broad and twice as long as the outer. Ovary on a stipe. Capsule almost spherical, 7mm. in diameter. V.

On stony slopes.—C. ASIA: 48 Pam.-Al. (Nura Tau, Dzhizman gorge, Andak, Tamerlanova's gate; Turkestan range: Kuduk Sai), 49 Tien Shan (Kaplanbek). Endemic. Descr. from the Dzhizman gorge. Type at Leningrad.

224. *A. REGELI* Trautvetter in A. H. P. IX (1884) 275.—*A. cupuliferum* var. *Regeli* O. Kuntze in A. H. P. X (1887) 292.—*A. Yatei* Aitchison et Baker⁵⁵ in Trans. Linn. Soc. Ser. 2, Bot. III (1888) 117.—Exs.: H F AM no. 179.

Bulb almost spherical, 1-2 cm. in diameter, clothed with papyraceous or almost coriaceous, blackish, cracked envelopes. Scape 30-70 cm. high. Leaves 2-3, linear-lanceolate, 0.5-1.5 cm. wide, \pm scabrid on the margin. Spathe $1/3$ - $1/2$ as long as the umbel, shortly acuminate. Umbels (1)-

⁵⁵ [*A. Yatei* from the Hari Rud valley, Afgahanistan, is a form with a solitary umbel, not tiered as in typical *A. Regeli*. —W. T. S.]

2-3-(4), arranged one above the other, fasciculate, more rarely hemispherical, few-flowered, lax; pedicels 2-3 times as long as the perianth, without bracteoles at the base. Segments of the narrowly campanulate perianth rose-coloured, delicate, withering and somewhat twisted after flowering, 9-13 mm. long, narrowing linear-lanceolate, subacute, the outer ones almost twice as broad. Filaments half as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{3}{5}$, coalescent with each other half-way in the free part, the inner ones triangular, broader and considerably longer than the outer. Ovary sessile. Capsule broadly ovoid, 7-8 mm. in diameter. V-VI.

Sandy deserts and rubbly slopes in the lower mountain zone.—C. ASIA: 45 Mountain Turkm., 44 Kara Kum. Gen. distr.: Iran. Descr. from the neighbourhood of Ashkhabad.

NOTE. Trautvetter doubted whether *A. Regeli* had been collected near Akhal Teke or at Karabakh. There is now no doubt that this species does not exist in the Caucasian flora.

225. *A. ILIENSE* Regel in Bull. Soc. Nat. Mosc. XLI, 1 (1868) 452.—Ic.: Fl. Turk. (1876) t. 15, f. 9-10.

Bulb spherical, 1-2 cm. in diameter, with black-brown papyraceous envelopes. Scape 15-35 cm. high, fairly slender. Leaves linear-lanceolate, \pm crisped on the margin, 7-20 mm. wide, almost equalling the scape. Spathe several times shorter than the umbel, shortly acuminate. Umbel 6-30-flowered, fasciculate or more rarely hemispherical, very lax; pedicels unequal, 2-10 cm. long, without bracteoles at the base. Segments of the narrowly campanulate perianth violet-rose with a dirty-green nerve, 10-15 mm. long, subacute, linear-lanceolate or lanceolate, the outer ones slightly or up to $1\frac{1}{2}$ times broader than the inner, erect after flowering. Filaments $\frac{2}{5}$ - $\frac{1}{2}$ as long as the perianth-segments, connate, and adnate to the perianth, for $\frac{3}{5}$ - $\frac{2}{3}$, coalescent half-way in the free part, the inner ones triangular, broader and considerably longer than the outer. Ovary on a short stipe. Capsule almost spherical, 6 mm. in diameter. V.

On rubbly slopes in the lower mountain zone, on sands and on outcrops of particoloured rocks.—C. ASIA: 40 Aral-Casp. (S. E. part), 41 Balkhash, 45 Mountain Turkm., 48 Pam.-Al. (Alai range), 49 Tien Shan (Mogol Tau). Descr. from R. Ili. Type at Leningrad.

Section 8. *CALOSCORDUM* (*Herbert*) *Baker* in Journ. Bot. III (1874) 290.—*Caloscordum* Herbert in Bot. Reg. XXX (1844) Misc. 66.—Bulb solitary, devoid of a rhizome, spherical. Leaf-sheaths subterranean. Pedicels with bracteoles. Perianth-segments with one nerve. Filaments entire, adnate to the perianth half-way. [Sp. 226.]

226. *A. NERINIFLORUM* (*Herbert*) *Baker* in Journ. Bot. III (1874) 290.—*Caloscordum neriniflorum* Herbert in Bot. Reg. XXX (1844)

Misc. 67.—*A. Thunbergi* Regel in A. H. P. III (1875) 234, non G. Don.—*Ic.*: Bot. Reg. XXXIII (1847) t. 5. [sub *C. nerinefolium*].⁵⁶

Bulb spherical, 1-2 cm. thick, with blackish papyraceous envelopes. Scape 10-25 cm. high, slender, often sinuous, with prominent nerves, sometimes 2 from one bulb. Leaves 2-6, narrowly linear, *c.* 1 mm. wide, canaliculate, smooth, shorter than the umbel. Spathe many times shorter than the umbel, acuminate. Umbel fasciculate or fasciculate-hemispherical, comparatively few-flowered, very lax; pedicels unequal, many times longer than the perianth (up to 10 cm. long), with bracteoles at the base. Segments of the campanulate perianth rose-violet with a strong darker nerve, 6-8 mm. long, linear-oblongate, acute, united for 1/3. Filaments half as long as the perianth-segments, adnate to the perianth half-way, subulate. Ovary sessile. VII-VIII.

On dry slopes.—E. SIBERIA: 33 Dauria (rarely). Gen. distr.: Mongolia, Japan-China. Descr. from Chusan.

Section 9. NECTAROSCORDERUM (*Lindley*) *Grenier et Godron*, Fl. France III (1855)⁵⁷ 212.—*Nectaroscorderum* Lindley in Bot. Reg. IX (1836) t. 1913.—Bulb solitary, devoid of a rhizome. Leaves, except the last one, embracing the stem for some distance, devoid of subterranean sheaths. Spathe caducous. Pedicels \pm discoidally expanded beneath the flower. Perianth-segments with 3-7 nerves. [Spp. 227-228.]

227. *A. TRIPEDALE* *Trautvetter* in Tr. S P B. Bot. Sada (A. H. P.) II (1873) 485; Boiss. Fl. Or. V (1882) 284.

Bulb spherical, *c.* 1.5 cm. thick. Scape 50-90 cm. high, clothed for 1/4-1/3 with the sheath of the last leaf. Leaves slender, delicate, 1-1.5 cm. wide. Spathe caducous. Umbel fasciculate, fairly multiflorous, rather dense; pedicels unequal, 2-4 times as long as the perianth, slightly discoidally expanded beneath the flower. Segments of the campanulate perianth white, reddish on the back, 12-15 mm. long, caducous, acute, the inner ones ovate, abruptly narrowed towards the base into a claw, considerably broader than the oblong outer ones. Filaments scarcely more than 1/3 as long as the [perianth-] segments, subulate. Style not exerted from the perianth. VI.

In crevices of rocks.—CAUCASUS: 24 S. Transcauc. Endemic. Descr. from Isti Su in Daralagyoza [Daralageza]. Type at Leningrad.

228. *A. DIOSCORIDIS* *Sibthorp et Smith*, Prodr. Fl. Graec. I (1806) 222.—*Nectaroscorderum siculum* var. *Dioscoridis* (*Sibthorp et Smith*) Boissier, Fl. Or. V (1882) 286.—*N. siculum* Schmalh. Fl. II (1897) 495 [non *Ucria*].

⁵⁶ [This was described by Herbert in 1844 as *C. neriniflorum* but figured by Lindley in 1847 as *C. nerinefolium*. Both epithets are fairly apt. On account of this species having no alliaceous odour it is best excluded from the genus *Allium*. The perianth-segments are fused at base as in *Northoscorderum* but the spathe is one-valved. —W. T. S.]

⁵⁷ [Grenier et Godron, Flore de France, III, was published in two parts:—1, pp. 1-384, in 1855 (probably May or June); 2, pp. 385-779, in 1856 (Sept.). —W. T. S.]

Bulb almost spherical, 1.5-2.5 cm. thick, with blackish, almost coriaceous envelopes. Scape 70-125 cm. high, smooth, clothed for 1/3-1/2 with the sheath of the last leaf, which is almost devoid of a lamina. Leaves 3-4, linear, 1-1.5 cm. wide, carinate, glabrous, smooth, approximately half as long as the scape. Spathe caducous. Umbel fasciculate, \pm few-flowered, rather lax; pedicels unequal, 2-4 times as long as the perianth, discoidally expanded beneath the flower, without bracteoles. Segments of the broadly campanulate perianth white with a greenish-reddish tinge and red nerves, 12-15 mm. long, acute, the inner broadly ovate, abruptly narrowed towards the base into a claw, considerably broader than the oblong outer ones. Filaments half as long as the perianth, subulate. Style not exerted from the perianth. V.

In shady woods.—EUROPEAN PART: 17 Crimea. Gen. distr.: Balkans-Asia Min. Descr. from Asia Minor.

KEY TO THE ALLIUMS OF EUROPE

VICTOR DE JANKA

(Translated by William T. Stearn)

[The following Key is translated from Janka, "Amaryllideae, Dioscoreae et Liliaceae Europaeae analytice elaboratae", pp. 50-56, published in the Hungarian Journal *Természetrájsi Füzetek* 10: 41-77 (Budapest, 1886). It states concisely the leading diagnostic features of various species which on account of their west European distribution are not included in the Flora URSS and Boissier, Flora Orientalis. But it naturally does not deal with species published since 1886 such as *A. Bormuelleri* Hayek (illustrated in Hooker, Icones 5, 3. t. 3279: 1935), *A. massaessylum* Batt. et Trabut (illustrated in Bull. Soc. Bot. France 39, t. 3: 1892), *A. melananthum* Coincy (illustrated in Coincy, Ecl. Pl. Hisp. 3. t. 11: 1897), *A. Parodi* Losc. (illustrated in Willkomm. Illust. Fl. Hisp. 7. t. 54: 1881-85), *A. Rouyanum* Gautier (illust. in Rouy, Illust. Fl. Europ. 10. t. 247: 1898) and *A. Schmitzii* Couthino (illust. in Bol. Soc. Broter. 13. t. 3: 1896). These species are, however, rare in nature and unknown in cultivation. The author, Victor Janka van Bulcs (1837-1890), was for part of his career a cavalry officer and travelled in the Balkan Peninsula and Italy; later (from 1870-1889) he was curator of the botanical section of the Hungarian National Museum at Budapest.]

- 112 All filaments simple [i. e. undivided] or very rarely the inner three with a short tooth on both sides at base ----- 113
 - Inner three filaments three-cusped at the tip, the middle cusp anther-bearing ----- 176
- 113 (112) Umbel typically capsule-bearing [i. e. without bulbils] 114
 - Umbel bulbil-bearing ----- 173
- 114 (113) Leaves distinctly stalked; blade very broad, oval-oblong 115
 - Leaves not stalked; blade narrower ----- 116
- 115 (114) Bulb tunics [envelopes] densely fibrous-netted; leaves sheathing the stem for much of its height, narrowed at base into a short stalk, pleated-ribbed; flowers greenish-yellowish.—
 - 1. *Allium victorialis* L.
 - Bulb (slender, cylindric) membranous-coated; leaves 2, basal very long stalked, flat; flowers white ----- 2. *A. ursinum* L.
- 116 (114) Leaves (or stem) more or less hairy ----- 117
 - Not hairy ----- 122
- 117 (116) Stem extremely short, scarcely emerging from the soil; (leaves flat) ----- 3. *A. Chamaemoly* L.
 - Stem taller ----- 118
- 118 (117) Leaves half-terete, channelled; perianth scarcely 1½ lines (3.3 mm) long ----- 4. *A. pilosum* Sibth. et Sm.
 - Leaves flat; perianth larger ----- 119
- 119 (118) Leaves circinate (i. e. coiled) ----- 5. *A. circinatum* Sieber
 - Leaves not circinate ----- 120

- 120 (119) Stamens shorter than the perianth; umbel outspread or slightly fastigate ----- 121
 —Stamens overtopping the perianth; umbel hemispherical—
 6. *A. vernale* Tenéo (*A. subvillosum* Salzm.)
- 121 (120) Perianth-segments oblong-lanceolate, bluntish, of uniform colour (i. e. entirely white); umbel outspread; leaves ciliate at the margin or even beneath; filaments $\frac{1}{3}$ shorter than the perianth ----- 7. *A. subhirsutum* L.
 —Perianth-segments lanceolate, acute, (white) with a purple keel (mid-vein); umbel fastigate; leaves ciliate-pilose on both sides; filaments $\frac{1}{2}$ shorter than the perianth ----- 8. *A. trifoliatum* Cyr.
- 122 (116) Stigma deeply three-lobed ----- 123
 —Stigma entire ----- 125
- 123 (122) Bulb with fibrous tunics, mounted on a horizontal rhizome; stem firm; flowers purplish ----- 9. *A. narcissiflorum* Vill.
 —Bulb simple (i. e. not mounted on rhizome), with membranous tunics; stem very slender; flowers milk-white ----- 124
- 124 (123) Perianth-segments oblong-linear; flowers always pendulous on one side of the umbel; bulbs crowded, oblong—
 10. *A. triquetrum* L.
 —Perianth-segments elliptic-lanceolate; flowers pendulous on all sides of the umbel; bulb solitary, globose -- 11. *A. pendulinum* Tenore
- 125 (122) Perianth-segments spreading or reflexed, never covering the capsule; leaves all basal ----- 126
 —Perianth-segments nearly always erect or coming together at the tip, at length covering the capsule ----- 130
- 126 (125) Flowers yellow ----- 12. *A. stramineum* Boiss.
 —Flowers not yellow ----- 127
- 127 (126) Perianth-segments oblong, blunt ----- 13. *A. nigrum* L.
 —Perianth-segments narrower ----- 128
- 128 (127) Perianth white or rose ----- 129
 —Perianth black-purple; segments linear—
 14. *A. atropurpureum* W. et K.
- 129 (128) Perianth-segments narrowly linear, acuminate, incurved and deflexed; bulb proliferous; leaves several -- 15. *A. Cyrilli* Tenore
 —Perianth-segments lanceolate, stellately spreading; bulb not proliferous; leaves basal, only 1 or 2—
 16. *A. decipiens* Fisch. (*A. tulipifolium* Ledeb.)
- 130 (125) Stem very hollow, part of it swollen-inflated ----- 131
 —Stem nowhere inflated ----- 132
- 131 (130) Stem inflated at the middle; [segments unequal, 6-8 mm. long; filaments uniform, to 1.3 cm. long; style stout, to 1.2 cm. long] ----- 17. *A. fistulosum* L.
 —Stem inflated below the middle; [segments plus or minus equal, 4-5 mm. long; filaments alternately broadened at base, 5 mm. long; style slender, to 5 mm. long] ----- 18. *A. Cepa* L.
- 132 (130) Leaves broad, almost lanceolate-linear ----- 133
 —Leaves narrow, exactly linear or thread-like ----- 140

- 133 (132) Stem sheathed or bearing leaves for much of its height
(up to or above the middle) ----- 134
—Stem scapose [leafless]; leaves all basal ----- 135
- 134 (133) Stamens long protruding; umbel densely globose; flowers
yellowish; plant tall, more than a foot [i. e. 60-150 cm.] high;
filaments all free, awl-like ----- 19. *A. obliquum* L.
—Stamens included (3 times shorter than the perianth); umbel
loosely fastigate or hemispherical; flowers purple [or rose]; plant
3-4 inches [usually 5-20 cm.] high; filaments joined between them-
selves, the inner three ovate-triangular with a short anther-bear-
ing cusp. ----- 20. *A. oreophilum* C. A. M.
- 135 (133) Stamens long protruding; spathe 2-valved; pedicels
drawn together, elongated, thickened at base.—
21. *A. caspium* (Pall.) M. Bieb.
—Stamens included ----- 136
- 136 (135) Perianth-segments lanceolate, stretched out, grooved;
pedicels drawn together. ----- 22. *A. phthioticum* Boiss. et Held.
—Perianth-segments broader, smooth, glistening; pedicels spread-
ing ----- 137
- 137 (136) Flowers yellow. ----- 23. *A. Moly* L.
—Flowers whitish or purplish ----- 138
- 138 (137) Stem 3-angled at the tip; spathe entire, 1-valved.—
24. *A. neapolitanum* Cyr.
—Stem not 3-angled at the tip; spathe 3-4-lobed ----- 139
- 139 (138) Inner perianth-segments narrower ----- 25. *A. roseum* L.
—Perianth-segments equal ----- 26. *A. permixtum* Cluss.
- 140 (132) Spathes ecaudate [i. e. without tail-like appendage at the
tip], much shorter than the umbel ----- 141
—Spathes caudate or caudate-cuspidate [i. e. drawn out into a
short or long tail-like appendage at the tip], one or both equal-
ling or longer than the umbel ----- 152
- 141 (140) Rhizome or bulbs not clothed with thread-like fibres --- 142
—Rhizome clothed with thread-like fibres; (leaves linear, flat) -- 148
- 142 (141) Leaves terete (i. e. round in section), awl-like or thread-
like ----- 143
—Leaves linear, flattened ----- 146
- 143 (142) Perianth 5 lines [1.1 cm.] long, longer than the pedicel—
27. *A. Schoenoprasum* L. (*A. sibiricum* L.)
—Perianth not exceeding 2 lines [4.4 mm.], much shorter than
the pedicels ----- 144
- 144 (143) Stamens $1\frac{1}{2}$ times as long as the perianth—
28. *A. sabulosum* Stev.
—Stamens not exceeding the perianth ----- 145
- 145 (144) Perianth-segments extremely blunt or almost truncate;
stamens a little shorter than the perianth—
29. *A. maritimum* Raf. (*A. erythraeum* Griesb.)
—Perianth-segments lanceolate, acuminate; stamens 2-3 times
shorter than the perianth ----- 30. *A. rubellum* M. B.

146 (142) Flowers yellowish—

31. *A. flavescens* Bess. (*A. ammophilum* Heuff)

—Flowers rose or purplish ----- 147

147 (146) Stamens equalling the perianth; leaves distinctly keeled beneath; tall ----- 32. *A. acutangulum* Schrad.

—Stamens overtopping the perianth; leaves convex below, not keeled; usually dwarf, about a span [about 22 cm.] high—

33. *A. montanum* Schmidt

148 (141) Stamens included ----- 149

—Stamens protruding ----- 151

149 (148) Pedicels equalling or shorter than the perianth ----- 150

—Pedicels longer than the perianth ----- 34. *A. odorum* L.

150 (149) Perianth bell-shaped; segments blunt or bluntish—

35. *A. tataricum* L. f.

—Perianth cylindric; segments acuminate -- 36. *A. diaphanum* Janka

151 (149) Stamens twice as long as the perianth; tooth-like appendages acuminate, slightly longer than the ovary; pedicels overtopping the spathe. ----- 37. *A. lineare* L.

—Stamens not so much overtopping the perianth; tooth-like appendages blunt, shorter than the ovary; pedicels not longer than the spathe; (leaves a little broader; flowers more numerous and deeper coloured) ----- 38. *A. strictum* Schrad.

152 (140) Stamens distinctly protruding ----- 153

—Stamens included ----- 161

153 (152) Bulbs clothed with the withered, closely overlapping, at the tip, truncate and split, leaf-sheaths; leaves flat or flattish 154

—Bulbs with simple [i. e. undivided] tunics; leaves rather terete or thread-like ----- 156

154 (153) Flowers purplish; sheaths obliquely truncate at the tip; stamens $1\frac{1}{2}$ times as long as the perianth.—

39. *A. suaveolens* Jacq. (*A. kermesinum* Rchb.)

—Flowers yellowish; sheaths transversely truncate at the tip; stamens twice as long as the perianth ----- 155

155 (154) Leaves narrowly linear, equalling or longer than the stem ---- 40. *A. ericetorum* Thore (*A. xanthicum* Griesb. et Schlenk.)

—Leaves broadly linear, scarcely more than $\frac{1}{2}$ as long as the stem ----- 41. *A. ochroleucum* W. et K.

156 (153) Umbel densely capitate-globose; spathe-valves shortly caudate (i. e. tailed) ----- 157

—Umbel effuse (loose with the pedicels spreading in all directions); spathe-valves elongate-caudate [i. e. long-tailed] ----- 159

157 (153) Perianth-segments acute or acuminate; (Stamens $1\frac{1}{2}$ times as long as the perianth ----- 42. *A. globosum* M. Bieb.

—Perianth-segments blunt ----- 158

158 (157) Stamens $1\frac{1}{2}$ times as long as the perianth; style much protruding ----- 43. *A. Weissii* Boiss.

—Stamens only a little overtopping the perianth; style little protruding ----- 44. *A. staticiforme* Sibth. et Sm.

- 159 (153) Flowers yellow; capsules ovate -----45. *A. flavum* L.
 —Flowers purplish; capsules almost circular ----- 160
- 160 (159) Perianth uniformly purple -----46. *A. pulchellum* G. Don
 —Perianth variegated with reddish-violet and yellow and hoary—
 47. *A. stamineum* Boiss.
- 161 (152) Perianth bell-shaped ----- 162
 —Perianth cylindric ----- 168
- 162 (161) Pedicels of equal length, scarcely as long as the perianth;
 (style protruding) -----48. *A. serbicum* Vis. et Panc.
 —Pedicels much longer than the perianth ----- 163
- 163 (162) Perianth-segments rounded, apiculate ----- 164
 —Perianth-segments acute ----- 167
- 164 (163) Filaments narrowly awl-like--49. *A. achaium* Boiss. et Orph.
 —Filaments attenuate-lanceolate ----- 165
- 165 (164) Perianth brown -----50. *A. fuscum* W. et K.
 —Perianth white ----- 166
- 166 (165) Perianth-segments not margined -----51. *A. pallens* L.
 —Perianth-segments red-margined -----52. *A. marginatum* Janka
- 167 (163) Style protruding -----53. *A. frigidum* Boiss. et Held.
 —Style included -----54. *A. exile* Boiss. et Orph.
- 168 (161) Spathe 1-valved ----- 169
 —Spathe 2-valved ----- 170
- 169 (168) Umbel slightly fastigiate; perianth-segments truncate—
 55. *A. callimischon* Link
 —Pedicels very unequal; perianth-segments acutish.—
 56. *A. Cupani* Raf.
- 170 (168) Spathe-valves spreading from the base ----- 171
 —Spathe-valves forming a cylindric sheath at base; (pedicels
 very unequal) -----57. *A. parciflorum* Viv.
- 171 (170) Pedicels very unequal -----58. *A. inaequale* Janka
 —Pedicels almost equal in length ----- 172
- 172 (171) Some of the pedicels nodding; stamens almost equalling
 the perianth; bulb-tunics membranous -----59. *A. tenuiflorum* Auct.
 —All pedicels erect; stamens $\frac{1}{3}$ shorter than the perianth; bulb-
 tunics at length fibrous-netted—
 60. *A. moschatum* L. (*A. flexuosum* W. et K.)
- 173 (113) Perianth cylindric—
 61. *A. melanantherum* Panc. (*A. moesiacum* Panc. olim)
 —Perianth bell-shaped ----- 174
- 174 (173) Filaments all untoothed ----- 175
 —Alternate filaments with a tooth on both sides—
 62. *A. cornutum* Clem.
- 175 (174) Stamens included or scarcely protruding--63. *A. oleraceum* L.
 —Stamens markedly protruding -----64. *A. carinatum* L.
- 176 (112) Umbel typically capsule-bearing (i. e. without bulbils) 177
 —Umbel bulbil-bearing ----- 193
- 177 (176) Stem bearing leaves up to the tip, the uppermost leaf
 clasping the base of the umbel -----65. *A. chamaespathum* Boiss.
 —Uppermost leaf very remote from the umbel ----- 178

178 (177) Stamens $\frac{1}{2}$ shorter than the perianth—

66. *A. gomphrenoides* Boiss. et Held.

—Stamens equalling or overtopping the perianth ----- 179

179 (178) Perianth-segments elongate, lanceolate ----- 180

—Perianth-segments elliptic, ovate or oblong ----- 181

180 (179) Leaves terete, hollow ----- 67. *A. Heldreichii* Boiss.

—Leaves linear, flat ----- 68. *A. acutiflorum* Loisel.

181 (179) Umbel fastigiate; (perianth smooth, white with greenish keels) ----- 69. *A. sardoum* Moris

—Umbel not fastigiate ----- 182

182 (181) Leaves very thinly hair-like or thread-like ----- 183

—Leaves firmer, broader ----- 184

183 (182) Pedicels shorter or scarcely longer than the perianth; perianth-segments with an acuteolate-scabrid [thornily rough] keel; stem low, 2-6 inches [5-16 cm.]; umbel the size of a hazelnut; bulb-tunics membranous -- 70. *A. rubrovittatum* Boiss. et. Held.

—Pedicels 2-3 times as long as the smooth perianth; bulb-tunics ultimately breaking up at base and tip into fibres; flowers very small ----- 71. *A. margariaceum* Sibth. et Sm.

184 (182) Leaves broadly linear, about $\frac{1}{2}$ inch [1-3 cm.] broad, keeled otherwise flat; anthers scarcely protruding; perianth-segments scabrid [rough] on back ----- 185

—Leaves narrower ----- 187

185 (184) Bulb simple [i. e. solitary] oblong-ovoid, continued upward into the stem; anthers reddish; (style short, included)—

72. *A. Porrum* L.

—Bulb almost rounded, made up of two bulbs comprised within a many-layered common tunic, between which is placed the stem-- 186

186 (185) Perianth purplish; style elongated, equalling or longer than the stamens ----- 73. *A. Ampeloprasum* L.

—Perianth yellowish; style extremely short—

74. *A. pyrenaicum* Costa et Vary.

187 (184) Anthers included or scarcely protruding; leaves keeled, otherwise flat ----- 188

—Anthers much protruding ----- 191

188 (187) Perianth smooth; bulb-tunics fibrous ----- 189

—Perianth scabrid on the back; bulb-tunic membranous ----- 190

189 (188) Flowers white, reddish on the back ---- 75. *A. baeticum* Boiss.

—Flowers black-purple ----- 76. *A. atrovioleaceum* Boiss.

190 (188) Leaves flat, keeled; pedicels very unequal, some longer than the perianth; inner perianth-segments entire—

77. *A. rotundum* L.

—Leaves half-terete, hollow; pedicels little unequal, shorter than the perianth; inner perianth-segments laciniate-cristate [i. e. the margin cut or torn into small teeth or crests]—

78. *A. cristatum* Boiss.

191 (187) Leaves half-terete, hollow; spathe persistent, 2-valved; the three simple [i. e. undivided] stamens about as long as the

perianth; capsule (ovate-triangular) shorter than the perianth, the valves cuspidate, at the tip shallowly emarginate [indented]—

79. *A. sphaerocephalon* L.

—Leaves linear, not hollow; spathe deciduous 1-valved; all stamens overtopping the perianth; capsule equalling or overtopping the perianth, the valves at the tip deeply emarginate [indented] 192

192 (191) Leaves keeled, otherwise flat; umbel exactly globose; perianth-segments shortly recurved mucronate at the tip; capsule ovate, almost rounded -----80. *A. commutatum* Guss.

—Leaves keeled, triangular; umbel oval; perianth-segments coming together at tip; capsule almost globose-triangular—

81. *A. descendens* L.

193 (176) Leaves flat, linear-lanceolate; stamens shorter than the pedicels ----- 194

—Leaves terete, hollow; stamens overtopping the perianth—

82. *A. vineale* L. (*A. affine* Boiss. et Held.)

194 (193) Stem bent into a ring below the umbel—

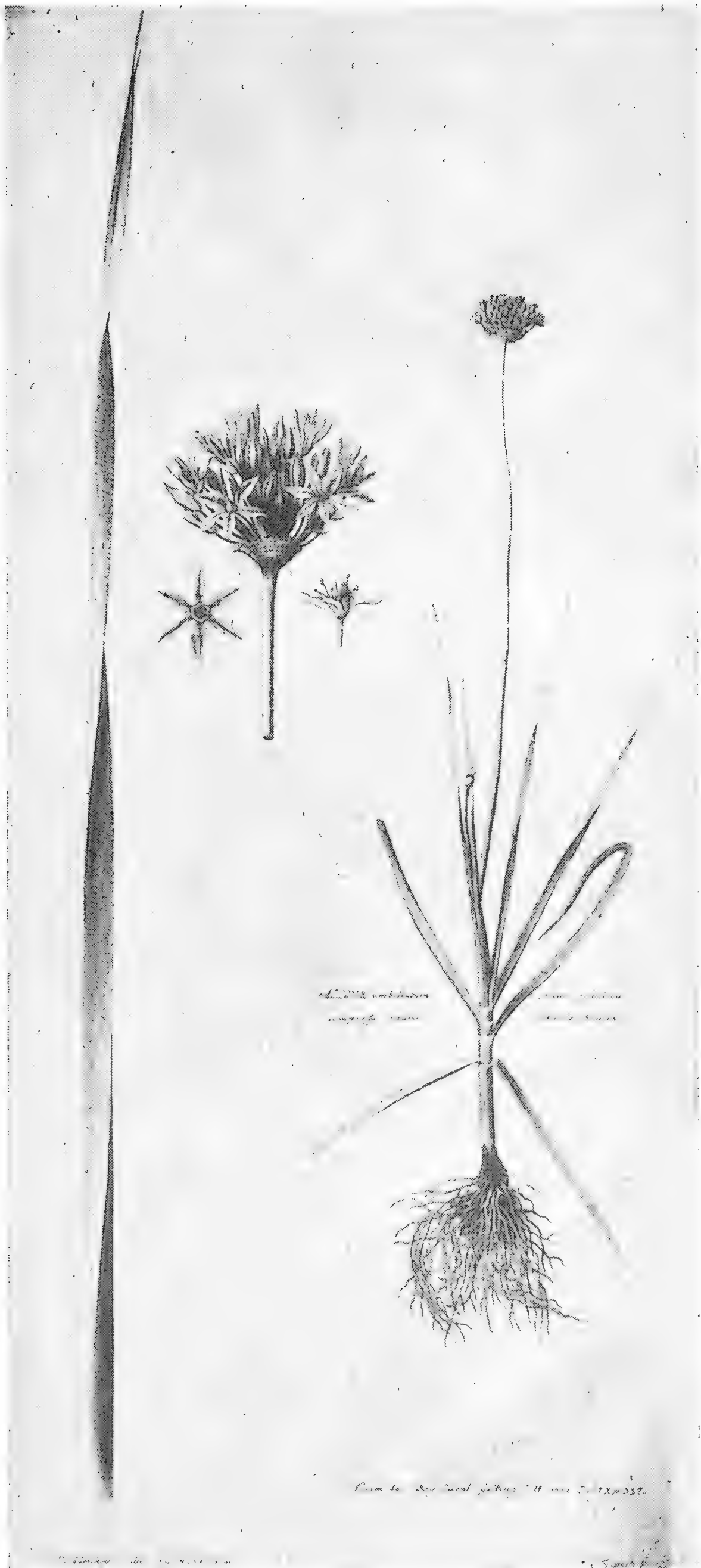
83. *A. controversum* Schrad.

—Stem straight throughout ----- 195

195 (194) Spathe much overtopping the umbel, contracted into a beak-like tip -----84. *A. sativum* L.

—Spathe shorter than the umbel -----85. *A. Scorodoprasum* L.

Synonymy and Distribution. For the synonymy and distribution of these European species, see K. Richter, *Plantae Europaeae* I: 198-210 (1890) and the floras of particular areas, e. g., by Rouy (1910) for France, Wilkomm et Lange (1862) for Spain, Couthino (1939) for Portugal, Briqurt (1910) for Corsica, Parlatore (1852) for Italy, Schinz and Keller (1923) for Switzerland, Hegi (1909) for Central Europe in general, Hayek (1931) for the Balkan Peninsula in general, and Halacsy (1940) for Greece in particular.



Allium ramosum, as figured by Haller, from British Museum (Natural History), London.
Plate 263

NOMENCLATURE AND SYNONYMY OF *ALLIUM ODORUM* AND *A. TUBEROSUM*

WILLIAM T. STEARN

Under the name *Allium odorum* L. two distinct species were confused by Eduard von Regel (1815-1892) in his "Alliorum adhuc cognitorum Monographia" (*Acta Horti Petrop.* 3. II) 176 (1875), the last comprehensive survey of the genus *Allium*, and they are commonly confused under this name in gardens and herbaria today.¹ Investigation of their synonymy shows that one should be called *Allium ramosum* Linn. (1753), with *A. odorum* Linn. (1767) and *A. tataricum* Linn. fil. (1781) as synonyms, the other *A. tuberosum* Rottler ex Sprengel (1825), with *A. uliginosum* G. Don (1827) and *A. tuberosum* Roxburgh (1832) as synonyms. The synonymy, description and distribution given by Regel for *A. odorum* cover both. Sir Joseph Hooker (*F. l. Brit. India* 6.343:1892) and Y. Prokhanov (in *Bull. Appl. Bot. Leningrad* 24.II.176:1931) distinguish between them but call them by different names. Hence some explanation seems necessary.

These two species are glabrous plants with many features in common:—clustered narrow conical or almost cylindric bulbs scarcely 1 cm. thick at base, mounted on a rhizome and covered with a light brown reticulately fibrous tunic; numerous linear leaves (about 4 to 9 to a bulb) up to 35 cm. long, their bases sheathing the stem up to 3-10 cm. above the bulb; terete or slightly angled stems about 24-50 cm. high; spathe at first one-valved, usually splitting in two and ultimately only a fragment persisting at the base of the umbel, shorter than the pedicels; umbel hemispherical or fastigiate, many (10-70)-flowered, about 3-5 cm. across, the pedicels ascending, 1-3 cm. long, with fairly large hyaline bracteoles at base; flowers pleasantly scented; filaments slender, shorter than the tepals (perianth-segments) and joined at base into a shallow ring; seeds somewhat flattened and D-shaped, about 3-4 mm. long, 2-2.5 mm. broad. In a living state they can, however, be easily distinguished.

Under cultivation *Allium ramosum* flowers from June into July, *A. tuberosum* (kiu ts'ai; Chinese chives) from August into October. During the last seven years I have had them growing side by side at Cambridge and Kew, and I have never seen them in flower at the same time. The flowers of *A. ramosum* are fairly large, rather campanulate, with ascending lanceolate-oblong tepals 6-10 mm. long, marked down the back with a reddish mid-line; the stamens are about half the length of the tepals; the valves of the capsule are broadest about or below the middle and are clasped by the withered tepals. The flowers of *A. tuberosum* are smaller and stellate, with more outspread narrowly ovate

¹ See T. H. Everett in *Gard. Chron.* 3rd. ser. 101. 185. (March 1937). The species from Mrs. L. B. Wilder's garden described here as "of special value because of its late season of bloom" and illustrated in fig. 71 as "*A. odorum*" is *A. tuberosum*. The other two plants (from Oslo and Enfield) belong to *A. ramosum*.

tepals 4-7 mm. long, white with a faint green or brownish mid-line on the back; the stamens are about $\frac{4}{5}$ ths the length of the tepals; the valves of the capsule are broadest above the middle (hence obcordate), with the tepals usually reflexed or withered away from them. The leaves of *A. ramosum* are usually a little fistulose with the underside convex, those of *A. tuberosum* solid and keeled beneath, but there is no

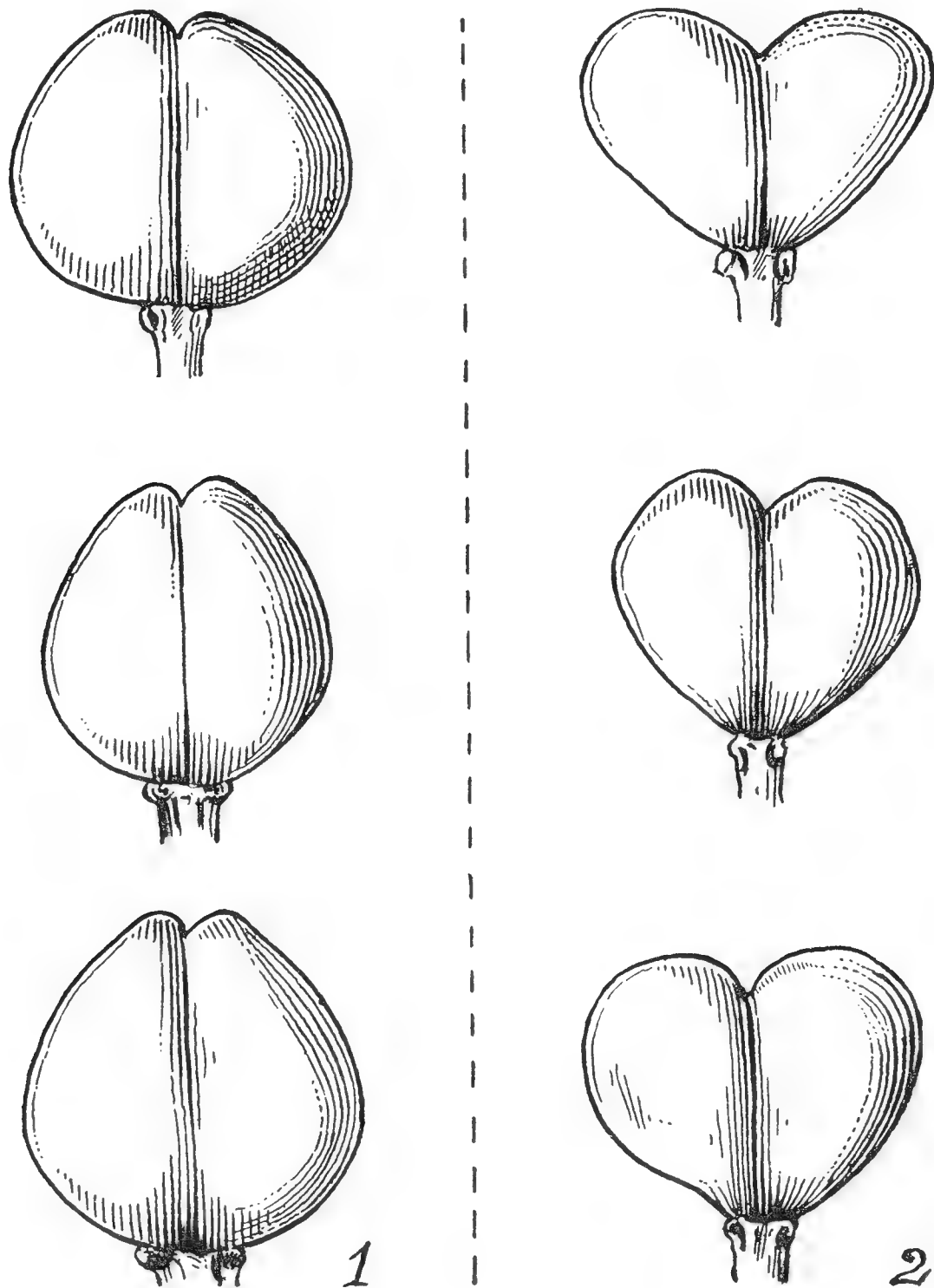


Figure 122. Capsule valves of (1) *Allium ramosum* Linn., and (2) *A. tuberosum* Rottler, with the withered perianth-segments removed. X4.5

significant difference in breadth, which varies in both from 1.5 to 8 mm. [For difference in capsule valves of these two species see Figure 122.] In behavior, general appearance and technical characters, the two diverge sufficiently to be rated as distinct species and they also differ in distribution, *A. ramosum* being a native of central Asia, *A. tuberosum* of south-eastern Asia. *A. tuberosum* is cultivated as a potherb and salad crop in China, Japan, the Philippines, the Dutch East Indies and India; its leaves, stems and flowers are eaten, and from a culinary viewpoint it would seem to be the Asiatic counterpart of the European chives (*A.*

Schoenoprasum Linn.) Those authors, such as Ascherson and Graebner (1905), who regard *A. tuberosum* as a broad-leaved, large-flowered form of *A. odorum* are mistaken. The flowers of both species are pleasantly hawthorn-scented with a faint trace of bitter almond but give out a strong onion smell when bruised.

Allium ramosum was the first to become known to European writers, this name being given by Linnaeus in 1753 (*Sp. Pl.* 1.296) to the *Allium scapo nudo tereti fãreto, foliis semicylindricis, staminibus corolla longioribus* of Johann Georg Gmelin (*Fl. Sibir.* 1. 52 pl. 11 fig. 1:1747). Gmelin's figure is a fairly good representation of the plant distinguished above as *A. ramosum*—there is a better figure in *Bot. Mag.* 28. pl. 1142 (1808) as *A. tataricum*—and shows that, in his diagnosis “staminibus corolla longioribus,” the word “longioribus” is a penslip for “brevioribus.” Linnaeus' account (1753) of his *Allium ramosum* is not, however, entirely based on Gmelin's (1747), since he cites Siberian material received from the Russian Prince Gregorei Demidoff. The Linnean herbarium contains a specimen labelled on the face “*A. ramosum*” and annotated on the back as “Gmelin, Fl. I. p. 52 n. 16” with a cryptic sign indicating that it had been collected by Traugott Gerber of Moscow; Demidoff included plants collected by Gerber in Astrachan and elsewhere among those he sent to Linnaeus.² This specimen lacks a bulb but is conspecific with Gmelin's plant and that in cultivation to-day. Indeed Gerber is to be credited with its introduction. In 1753 the celebrated Swiss botanist Albrecht von Haller, then a professor at Göttingen, described and figured an “*Allium umbellatum, foliis fistulosis, compressis radice reticulo obducta quod cum nomine campestris juncifolii floribus albis umbellatis Gerberi ad nos pervenit*” (*Comment. Soc. Reg. Sci. Gottingensis* 2.337. pl. 9) This is undoubtedly our plant. (Plate 263) A note on Haller's plate states that it was drawn in June 1750 (“Kaltenhofer del. 1750 mense Junio”). Clearly Gerber sent both seed and specimens to his friends in Europe, and *A. ramosum* raised from them was grown in European gardens by 1750. In 1767 (*Mantissa prima*, 62) Linnaeus described as *Allium odorum* a plant grown in the Uppsala Botanic garden. From his description this is clearly the same as Haller's *Allium umbellatum, foliis fistulosis etc.* and Gmelin's *Allium scapo nudo etc.*—his own *Allium ramosum*. That Linnaeus in 1767 failed to recognise in the living *A. odorum* the plant he had earlier named *A. ramosum* from dried material and from Gmelin's account is no argument for our doing likewise. Linnaeus' memory became very bad during his later years and a dried specimen often looks so different from a living plant of the same species as to be almost unrecognizable. Under the international rules of botanical nomenclature the name *A. ramosum* Linn. (1753) takes precedence over *A. odorum* Linn. (1767) and hence is here restored.

² See B. D. Jackson, *Index to the Linnean Herbarium*, 12, 18, 20 (1912) published as a supplement to *Proc. Linn. Soc.* 124th Session, 1911-12.

Regel's monumental work states that *A. odorum* "habitat in Siberia Uralensi, altaica, baicalensi dahurica et orientali, in regione amurensi et ussuriensi, in Mongolia, in omni Japonia, in China boreali et australi et in alpihus Indiae orientalis. In hortis culinariis Asiae mediae et australis saepe colitur . . . Das *A. odorum* L. ist vom Ural an durch ganz Mittelasien verbreitet und wird in den Küchengärten der Chinesen, sowie in Ostindien zum Küchengebrauch kultivirt . . . Diese kultivierte Form ist es vorzugsweise, welche das *A. tuberosum* Roxb. darstellt." As already noted these remarks cover two distinct species. The cultivated "*A. odorum*" is that distinguished above as *A. tuberosum* Rottler. The evidence relating to its identity and nomenclature must now be considered.

By Maximowicz (1859) and Prokhanov (1931) this species is called *Allium chinense* G. Don; by Merrill (1935) *A. uliginosum* G. Don; by other authors, e. g. Sir Joseph Hooker (1892), *A. tuberosum* Roxb. if distinguished from *A. odorum* Linn. sensu stricto. That it is *A. tuberosum* of Roxburgh there can be no doubt. Roxburgh's description (first published in 1832 but available in manuscript to his contemporaries for at least thirty years previously) clearly indicates its main features. Any uncertainty as to the application of the name *A. tuberosum* Roxb. is removed by an authentic specimen in Sir James E. Smith's herbarium (now the property of the Linnean Society of London) and by authentic drawings. William Roxburgh (1751-1815),³ a Scots doctor in the employ of the Hon. East India Company, reached India in 1776 and set about preparing a *Flora Indica*. He was a good observer and to supplement his descriptions Indian artists made upwards of 2,000 coloured drawings from the living plants. Three hundred of them were published between 1795 and 1819 as *Plants of the Coast of Coromandel*. The rest have never been published. Coloured copies are available at the Royal Botanic Garden, Calcutta, at the India House, London and the British Museum (Natural History), London, those at the last institution having once belonged to Roxburgh's friend, John Fleming (1747-1829); sketches made from them by Sir William Jackson Hooker in preparation for his son Joseph's Indian journey are at the Royal Botanic Gardens, Kew. The drawing of *A. tuberosum* Roxb. in these collections depicts our plant excellently. (Plate 264) Roxburgh died in 1815; that part of his manuscript *Flora Indica* containing the description of his *A. tuberosum* did not appear in print until 1832. His friend the Rev. William Carey (1761-1834) published in 1814 his *Hortus Bengalensis*, but the name *A. tuberosum* Roxb. printed here is simply a nomen nudum: "*Allium tuberosum* R. In Gardens in Bengal. 4."

Not being validly published until 1832, the name *A. tuberosum* Roxb. is apparently invalidated by the earlier published homonym *A. tuberosum* Rottler ex Sprengel (*Systema* 2. 38: 1825). Hence Merrill has adopted for *A. tuberosum* Roxb. the name *A. uliginosum* G. Don, taking this as published in 1832. If that were so, *A. uliginosum* G. Don

³ cf. G. King in *Annals Roy. Bot. Gard. Calcutta* 5 1-9 (1895).



Allium tuberosum, as represented in a Roxburgh drawing once the property of John Fleming. British Museum (Natural History), London.

would likewise be invalid, since Ledebour in 1829 described another species as *A. uliginosum* Ledebour (—*A. Ledebourianum* Schultes). George Don's "Monograph of the Genus *Allium*" (*Mem. Wernerian Nat. Hist. Soc.* 6. 1-102) was, however, published early in 1827,⁴ although the title page of volume 6 of the Wernerian Natural History Society's Memoirs for 1826-1831 is dated '1832.' Don proposed three names—*A. uliginosum*, *A. chinense* and *A. Thunbergii*—which apparently relate to our species. But the earlier hitherto obscure *A. tuberosum* Rottler ex Sprengel must be considered first.

Sprengel's diagnosis is brief:—"tuberosum Rottl. 62. *A. caule tereti basi foliato, foliis linearibus flaccidis caulem aequantibus, umbella fastigiata erecta spatham superante, petalis oblongis obtusiusculis stamina aequantibus. Malabar.*"

Johann Peter Rottler (1749-1836),⁵ to whom Sprengel credited the species-name *Allium tuberosum*, was attached to the Danish mission at Tranquebar in Eastern Madras. Malabar is in Western Madras, but in former times "Malabaria" indicated southern India in general. No *Allium* is native to this area. Hence Rottler's obscure *A. tuberosum* must have been a cultivated plant. Rottler had a garden at Tranquebar, and the specimen he sent Sprengel at Halle probably came from this. Wallich knew Rottler well (as did also Roxburgh)⁶ and he obtained specimens from Rottler's Tranquebar garden. Hence it is highly significant that the specimens (Wallich 5068) from Tranquebar labelled "*A. tuberosum*" in the Hon. East India Co. Herbarium at Kew belong

⁴ For evidence, see Stearn in *Journal of Bot.* 74.322 (1936).

⁵ cf. Christensen, *Den Danske Botaniks Historie* 1.119, 2.98 (1924).

⁶ Wight and Arnott's account of the relations between the pioneer botanists of India is illuminating:—

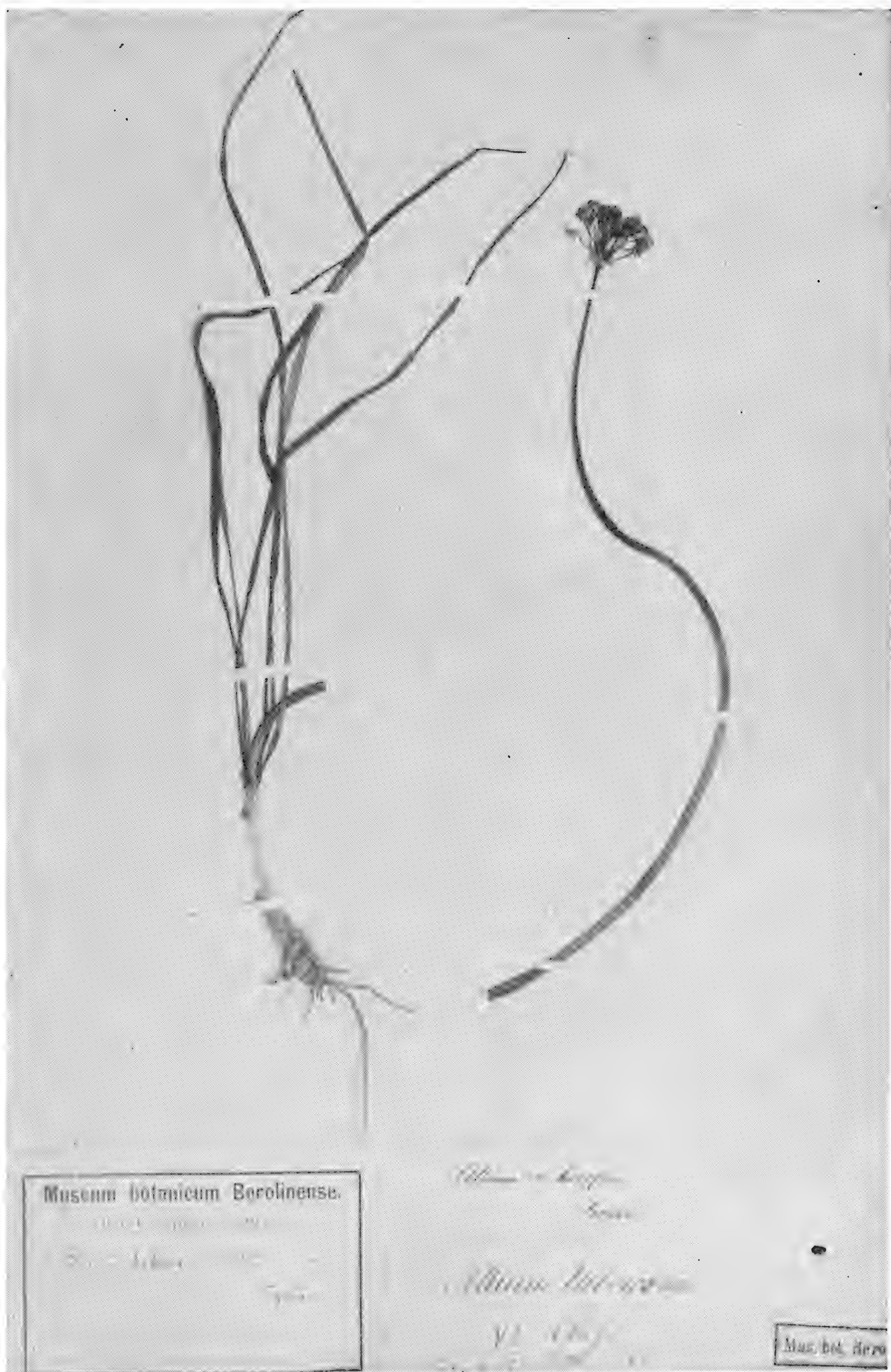
"In the year 1768, John Gerard Koenig, a native of Denmark, a pupil of Linnaeus and an enthusiastic cultivator of natural science, landed in India, as physician to the Tranquebar missions. His example and instructions diffused a similar taste among his companions, and hence originated the botanical labours of the society of "United Brothers"—until Koenig made his appearance no one in India had studied the vegetation according to the Linnean rules. His example was soon followed by many eminent individuals: among whom may be mentioned Jones, Fleming, Hunter, Anderson, Berry, John, Roxburgh, Heyne, Klein, Buchanan, Hamilton, and the venerable Rottler, the only survivor of the illustrious group. Most of these formed themselves into a society for the purpose of promoting Botany: plants were industriously collected throughout all the Peninsula as well as in Ceylon, and were not infrequently examined and named by the society in common —By degrees, however, their opportunities of meeting grew less frequent, and their confidence in themselves greater, so that Roxburgh, Klein and Rottler commenced attaching names without consulting their friends: an interchange of specimens, however, still continued, so that it was rarely difficult for the one to know what was intended by the other. The value of such specimens was quickly felt, nor were they slow in transmitting them to Europe. Many of these plants were published in different works, sometimes under the name given by the donors". (R. Wight & G. Walker-Arnott, *Prodr. Fl. Penin. Ind. Orient.* 1.VII, XI:1834).

to *A. tuberosum* Roxb. The Kew herbarium also possesses Rottler's manuscript list of specimens in his private herbarium. There is no "*Allium tuberosum* Rottl." in this list: there is however "*Allium tuberosum* Roxb."! This evidence suggests that Rottler sent a specimen of *Allium tuberosum* Roxb. to Kurt Sprengel (1766-1833) and that Sprengel took the name *A. tuberosum* to be of Rottler's coining and erroneously attributed it to him. But he describes the stem as terete and the stamens as equalling the tepals, whereas in *A. tuberosum* Roxb. the stem is somewhat angled and the stamens are slightly shorter than the tepals. On account of this discrepancy between the original diagnoses of *Allium tuberosum* Rottler (1825) and *A. tuberosum* Roxb. (1832), Kunth in 1843 renamed the latter *A. Roxburghii* Kunth, presuming them to represent different species.

In 1891 part of Sprengel's herbarium came into the possession of the Botanisches Museum, Berlin-Dahlem. It contains the type-specimen of *Allium tuberosum* Rottler and by the courtesy of Prof. Ludwig Diels I have been able to examine this. (Plate 265) The narrow bulb is covered with the remains of a yellowish fibrous netted covering; the six leaves are united into a common sheath for about 6 cm. from the base of the bulb and are up to 25 cm. long, 2-3 mm. broad; the broken stem is about 32 cm. high, with no angling evident in its dry state; the withered spathe is shorter than the pedicels; the umbel is 2.5 cm. across, with about 25 flowers, the pedicels ascending and 1-1.5 cm. long; the tepals are 4-5 mm. long, 2 mm. broad, more or less acute, with the stamens slender and about 4 mm. long, the dehiscent anthers about 1 mm. long; the largest ovary, pressed flat, is about 2 mm. high, 3 mm. broad in its upper part, with the tepals reflexed; the style is up to 3 mm. long. It is *Allium tuberosum* Roxb.! Hence the name *A. tuberosum* is to be retained for the plant with which it has so long been associated, but owing to its premature publication by Sprengel it must be attributed to Rottler ex Sprengel and not to Roxburgh, its original author.

Some other names applied to our plant can now be considered—*A. uliginosum* G. Don, *A. chinense* G. Don and *A. Thunbergii* G. Don. These are all "book species," i. e. not described from specimens actually before the author of their names, George Don the younger (1798-1856), but merely based on descriptions published earlier under erroneous names by Carl Peter Thunberg (1743-1828) and João de Loureiro (1710-1791).

Allium uliginosum G. Don, *Mon.* 60 (1827) is primarily based on "*Allium angulosum*, Lour. Cochin, p. 203," non Linn., with "*A. senescens* Thunb. Jap. p. 132" as a second synonym. Loureiro's note that it loved moist places ("amat loca humida") obviously suggested Don's specific name. The characters attributed to it by Loureiro—the two-edged scape, the white flowers in flattish umbels, etc.—the use of its leaves for culinary purposes—the citation of Gmelin's *cepa scapo nudo, subangulo farcto, foliis linearibus, subtus angulosis, staminibus corolla brevioribus* (*Fl. Sibir.* 1 58 pl. 14 f. 2) which, though actually representing the true *A. angulosum* Linn., might easily be taken by an inexperi-



Allium tuberosum. Type specimen from Rottler in Sprengel's Herbarium, Botanisches Museum, Berlin.



Allium tuberosum. Specimen under the name. *A. odorum* in Thunberg's Herbarium Botaniska Museet, Uppsala.



Allium Thunbergii. Type specimen under the name *A. orodum* in Thunberg's Herbarium, Botaniska Museet, Uppsala.

enced or hasty observer for a crude representation of *A. tuberosum* Rottler—the Chinese name “Kieu tsai”⁷ still applied in China to *A. tuberosum* Rottler, as specimens bought in a Pekin market in August 1934 as “Kutai” clearly show—all these together leave no doubt that Loureiro’s “*A. angulosum*,” and consequently G. Don’s *A. uliginosum*, is the same as *A. tuberosum* Rottler.

Allium chinense G. Don, *Mon.* 83 (1827) is based entirely on “*A. triquetrum*, Lour. *Cochin* p. 202,” non Linn. Prokhanov (1931) adopts it as the correct name for *A. tuberosum*, but Loureiro’s description of the flowers as “dilute violacea” excludes that species, together with the true *A. triquetrum* Linn. of Europe and North Africa. Don placed it among his “Species non satis notae” and among them it must remain.

A. Thunbergii G. Don, *Mon.* 84 (1827) is based on “*Allium odorum*, Lour. *Cochin* p. 203. Thunb. *Fl. Jap.* p. 132” and described as having “Bulbus ovatus, simplex, albus scapus spithamaeus, foliis paulo brevior. Flores violacei.” These particulars mostly come from Thunberg’s *Flora Japonica*, 132 (1784). Together with the epithet *Thunbergii*, they indicate that Don intended the name primarily for a species gathered in Japan and erroneously determined by Thunberg as “*A. odorum* L.” There are two sheets thus labelled in Thunberg’s herbarium at the Universitetets Botaniska Museet, Uppsala. They represent two quite different species. One is *A. tuberosum* Rottler (Plate 266) but because Thunberg’s specimen lacks a bulb it cannot be accepted as the basis of Thunberg’s account and consequently as the type of *A. Thunbergii*. The other sheet holds three specimens, one with an ovoid bulb about 2 cm. long, 1 cm. broad, and nine pink-tinged flowers, the tepals about 4 mm. long, the stamens and style long-exserted, which must evidently be taken as the type of *A. Thunbergii* G. Don (Plate 267); it and the other two specimens belong to the species commonly known as *A. japonicum* Regel (*Mon.* 33: 1875) and have nothing to do with the species described as “*A. Thunbergii* Don” in Regel’s *Mon.* 235 (1875) which is *Caloscor-dum nerinifolium* Herbert (1847), syn. *Allium nerinifolium* (Herb). Baker.

The involved synonymy of these plants can now be set out:—

ALLIUM CHINENSE G. Don

“*A. triquetrum*” Loureiro, *Fl. Cochinch.* 202 (1790)—non Linn. (1753).

A. chinense G. Don. *Mon. Allium* (Mem. Wernerian Nat. Hist. Soc. 6) 83 (1827); Merrill, Comment. Loureiro’s *Fl. Cochinch.* (Trans. Amer.

⁷ The traditional Chinese name for *A. tuberosum* is *kiu ts’ai*, in modern Pekinese *chiu ts’ai*, in Cantonese *kau ts’oi* or *go choi*, which has given rise to the Malayan and Sundanese name *kuchai* (also rendered *cuchay*, *kootjaj* and *kotjaj*) and the Javanese *puchai* (also rendered *pootjaj*), the plant having been carried to the Philippines, Java and Malaya by Chinese settlers; in these hot regions it does not flower freely and seed has continually to be imported from China. To English residents in Malaya it is known as *Chinese chives*.

Phil. Soc., new ser. 24. II) 106 (1935)—non Maximowicz (1859), cf. *A. tuberosum* Rottler.

Type-locality:—"in China et Cochinchina" (G. Don). An obscure plant, known only from Loureiro's description: "*Folia* redicalia, triangularia, sub-pedalia. *Bulbus* oblongatus tunicatus parvus, albus. *Scapus* nudus, tenuis, teres, foliis subaequalis. *Flos* dilute violaceus: Umbella plana: *staminibus* simplicibus. Colitur in Cochinchina, & China . . . Usus praecipuus Culinarius." Loureiro gives "Kieu" as its Anamese and "Kiai" and "Kiao theu" as its Chinese names.

ALLIUM RAMOSUM Linnaeus

A. scapo nudo tereti farcto, etc., Gmelin, Fl. Sibir. 1.52 pl. 11 f. 1. (1747).

Type-locality:—"in omni Sibiria frequens, loca amat aperta et sicca" (J. G. Gmelin).

A. umbellatum foliis fistulosis, compressis, etc., Haller in Comment. Soc. Reg. Sci. Gottingen 2. 337 pl. 9 (1753).

A. ramosum Linn. (!) Sp. Pl. 1. 296 (1753), reimpr. in Richter, Caroli Linnaei Syst. Codex Bot. 312 (1840); C. H. Grey, Hardy Bulbs 3. 60 (1938)—non Jacquin (1781), cf. *A. obliquum* Linn.

Type-locality:—"in Siberia" (Linn.)

A. odorum Linn. Mantissa 62 (1767), reimpr. in Richter, Caroli Linnaei Syst. Codex Bot. 315 (1840); Treviranus, Allii Species Hort. Bot. Wratislav. 14 (1822); G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. 6) 97 (1827); Ledebour, Fl. Ross. 4. 185 (1853); Regel, All. Mon. (Acta Horti Petrop. 3 II) 176 p.p. (1875); Prokhanov in Bull. App. Bot. Leningrad 24. II (1930) 176 (1931); Vvedensky in Komarov, Fl. URSS. 4. 163 (1935); Everett in Gard. Chron. 3rd. ser. 101 185 p.p. excl. icone (1937).

Type-locality:—"in Europa australi" (Linn.)

A. tataricum Linn. fil. Suppl. Pl. 196 (1781): de Candolle in Redoute, Liliac. 2 pl. 98 (1804); Kew-Gawler in Bot. Mag. 28 pl. 1142 (1808)—non Regel (1875), cf. *A. inderiense* Fischer & *A. longiradiatum* (Regel) Vved.

Type-locality:—"Sibiria" (Linn. fil.).

A. Potanini Regel (!) in Acta Horti Petrop. 6. 295 (1879); *Butomissa tatarica* (Linn. f.) Salisb. ex Jackson et Hooker f., Index Kew. 1. 362 (1895).

Type-locality:—"Mongolia in valle fluvii Schurik in solo arenoso" (E. Regel).

FIGURES:—Gmelin, Fl. Sibir. 1 pl. 11; Comment. Soc. Reg. Sci. Gottingen 2. pl. 9; Redoute, Liliac. 2. pl. 98; Bot. Mag. 28. pl. 1142.

DISTRIBUTION:—U. S. S. R., widespread in southeastern Siberia and possibly extending into the Far Eastern Area, being recorded by Vvedensky (1935) from the following Soviet floristic regions:—28, Irtysh (east), 29, Altai, 31, Lena-Kolyma, 32, Angara-Sayan, 33, Dauria, 36, Zeya-Bureya and 38, Ussuri (although records from here may refer to *A. tuberosum*) Mongolia (Tannu Ola range). According to Krylov,

Fl. Zapad. Sib. 3. 360 (1929), its western limit in Western Siberia appears to be about 80° E, and its northern limit 54°30' N; it occurs near Kamen and Antonova on the river Ob; in Eastern Siberia it extends further north, being found in the Yenisei region (near Krasnoyarsk and Kansk) as well as in the Yakutsk and Irkutsk regions. It is recorded from southwestern Tibet and western Nepal, but its range as a whole is very imperfectly known.

ALLIUM THUNBERGII G. Don, sec. Koidzumi.

“*A. odorum*” Thunberg (!), Fl. Jap. 132 (1784)—non Linn. (1767), cf. *A. ramosum* Linn.

A. Thunbergii G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. 6) 84 p.p. (1827); Koidzumi in Bot. Mag. Tokyo 39. 312 (1925); Makino & Nemoto, Nippon Shokubutsu Soran, 2nd. ed. 1537 (1931); Terasaki, Nippon Shokubutsu Zufu 1442 cum icone (1933)—non A. Gray (1859), cf. *A. Grayi* Regel; non Regel (1875), cf. *Caloscordum nerinifolium* Herbert.

Type-locality:—“in China et Cochinchina, Lour. in Koraedo, Thunb.” (G. Don).

A. japonicum Regel (!) All. Mon. (Acta Horti Petrop. 3. II) 33 (1875); Franchet & Savatier, Enum. Pl. Jap. 2. 77 (1877), 528 (1878); Mikino in Iinuma, Somoku Dzusetu 3rd ed. 6. pl. 37 (1910).

Type locality:—“in Japoniae insula Kiusiu in monte Kundchasan inque in insula Nippon prope Yukohama et in monte Fakone, legit Maximowicz.” (E. Regel).

A. Taqueti H. Léveillé in Fedde, Rep. Sp. Nov. 5. 283 (1908); fide H. K. A. Shaw in Notes Roy. Bot. Gard. Edin. 16. 147 (1931).

Type-locality:—“Corea: Quelpaert, supra 1200 m. oct. 1906; no. 259 (Urb. Faurie); Hallaisan, 1400 m. oct. 1907; no. 385 (Taquet)” (H. Léveillé).

Figures:—Terasaki, Nippon Shokub. 1442; Iinuma, Somoku Dzuset. 3rd ed. 6. pl. 37.

DISTRIBUTION:—Japan, Korea (Quelpaert Island), north China (Shansi).

ALLIUM TUBEROSUM Rottler ex Sprengel.

Porrum sectivum minus juncifolio Kaempfer, Amoer. Exot. 831 (1712).⁸

⁸ Although neither Kaempfer nor Noronha describe their respective plants, the one cultivated in Japan, the other in the Dutch East Indies, it is evident from the Chinese character given by Kaempfer and the vernacular name *cuchay* (a corruption of *kiu ts'ai*) given by Noronha that they refer to *A. tuberosum*. This Chinese character goes back to the Han period (c. 206 B. C.—220 A. D.), being listed in the Han dictionary *Shuo wên* by Hsü Shen as the name of a vegetable which, once sown, grows permanently. It probably began as a diagrammatic representation of two shoots growing out of the ground. Both Chinese and Japanese writers today associate it with *A. tuberosum*, called *kiu*, *chiu*, *kau* and *go* by the Chinese, *nira* by the Japanese. The word *ts'ai*, *ts'oi*, or *choi* means “vegetable”, usually one whose green leaves are eaten as food.

“*A. angulosum*” Loureiro, Fl. Cochinch. 203 p.p. excl. syn. (1790)—non Linn. (1753).

A. sinicum Noronha in Verh. Batav. Gen. 1790 art. 4. p. 6 (1790) nomen nudum.⁸

A. tuberosum Roxburgh, Hortus Bengal. 24 (1814), nomen nudum.

Type-locality:—“in gardens in Bengal” (W. Roxburgh).

A. tuberosum Rottler (!) ex Sprengel, Caroli Linnaei Syst. Veg. 2. 38 (1825); G. Don, Mon. Allium (Mem. Wernerian Nat. Hist. Soc. 6) 91 (1827); C. H. Grey, Hardy Bulbs 3.70 (1938); Stearn in Gard. Chron. 3rd. ser. 114. 88 (1943).

Type-locality:—“Malabar” (K. Sprengel).

A. uliginosum G. Don, Mon. Allium 60 (1827); Merrill, Comment. Loureiro's Fl. Cochinch. (Trans. Amer. Phil. Soc. new ser. 24 II 106 (1935)—non Ledebour (1829), cf. *A. Ledebourianum* Schultes; non Kitaibel apud Kanitz (1864), cf. *A. acutangulum* Schrader.

Type-locality:—“in China, et Cochinchina (Loureiro), in Insula Nipon, Thunberg,” (G. Don).

A. tuberosum Roxburgh (!) Fl. Indica, 2nd ed. 2. 141 (1832); Baker in Journ. of Bot. 12. 291 (1874); J. D. Hooker, Fl. Brit. India 6. 342 (1892).

Type-locality:—“cultivated about Calcutta by the Hindoos” (W. Roxburgh).

A. Roxburghii Kunth, Enum. Pl. 4 454 (1843).

Type-locality:—“cultum prope Calcuttam” (C. S. Kunth).

“*A. tricoccum*” Blanco, Fl. Filipin. 239 (1837), 3rd ed. 1.301 cum icone (1877)—non Aiton (1789).

“*A. odorum*” auct. p.p., e.g. Regel, All. Mon. (Acta Horti Petrop. 3. II) 176 p.p. (1875); C. H. Wright in Journ. Linn. Soc. Bot. 36. 124 (1903); Makino in Iinuma, Somoku Dzusetsu 6. pl. 42 (1910); Bois, Pl. Aliment, 1. 511 cum icone (1927); Ochse, Vegetables Dutch East Indies 450 (1931); Teresaki, Nippon Shokubutsu Zufu 1443 cum icone (1933); Gagnepain in Lecomte, Fl. Gen. Indochine 6. 813 (1934); L. B. Wilder, Adventures with Hardy Bulbs 49 (1936); Everett in Gard. Chron. 3rd. ser. 101. 185 p.p. fig. 71 (1937)—non Linn. (1767), cf. *A. ramosum* Linn.

A. Clarkei Hooker fil. (!) Fl. Brit. Ind. 6. 344 (1892);⁹ Blatter, Beautiful Fl. Kashmir 2. 174 (1928).

Type-locality:—“Kashmir at Skardo, alt. 7-11000 ft., Clarke” (J. D. Hooker).

A. odorum f. *tuberosum* (Roxb.) Ascherson & Graebner, Synop. Mitteleurop. Fl. 3. 119 quoad syn. *Roxburghii* excl. descrip. (1905).

A. Argyi H. Léveillé (!) Nouv. Contrib. Liliac. Chine 16 (1906), ex.

⁹ Hooker describes the filaments of the inner stamens as “broadly oblong, obtusely-toothed below the middle” but they appear to be subulate in his material at Kew.

Mem. Pontif. Accad. Roma, Nuovi Lincei 24. 350 (1906), reimpr. in Fedde, Rep. Sp. Nov. 3 371 (1907).¹⁰

?*A. jalvanum* Nakai in Bot. Mag. Tokyo 27 214 (1913).¹¹

A. yesoense Nakai in Bot. Mag. Tokyo 36 116 (1922) fide Nemoto, Nippon Shokubutsu Soran Hoi 1051 (1936).

Type-locality:—"Kiang Sou: (d'Argy) xxx Les Chinois mangent les feuilles xxx Nom. Chinois: Kien-Tsai" (H. Lévêillé).

"*A. chinense*" Maximowicz, Prim. Pl. Amur. (Mem. Acad. Sci. St. Petersb. Sav. Etrang. 9) 284 (1859); Prokhanov in Bull. Appl. Bot. Leningrad 24. II (1930) 164-171, 176, 181 (1931)—non G. Don (1827).

FIGURES:—Blanco, Fl. Filipin. 3rd ed. as "*A. tricoccum*"; Iinuma, Somoku Dzuset. 3rd ed. 6 pl. 42; Bois, Pl. Aliment. 1. 511; Teresaki, Nippon Shokub. 1443; Bull. Appl. Bot. Leningrad 24. II. 166, 167; Gard. Chron. 3rd ser. 101. 185 fig. 71 (March 1937).

Distribution:—eastern Asia, but its original range, like that of many long-cultivated plants, is uncertain; in a wild or naturalized state it has been collected in east Mongolia, Manchuria, Korea (Quelpaert island), Japan, Formosa, China (Chihli, Shantung, Kiangsu, Hong Kong, Hainan, Kwangtung, Hupeh, Hunan, Shensi, Yunnan), west Tibet, Siam, north India (Assam) and Nepal: it is cultivated as a salad crop and pot-herb in Japan, China, Chinese Turkistan, India, the Dutch East Indies and the Philippines, and occasionally as an ornamental garden plant in Europe (France, Switzerland, England, Sweden and possibly elsewhere) and U. S. A. under a variety of names, e.g. *A. odorum*, *A. Heldreichii* (at Basel), *A. recurvatum* (at Geneva).

No one can study *Allium* for long without feeling the need for divisions of the genus smaller and more homogeneous than the currently accepted sections of Regel's monograph (1875). Particularly is this true of Regel's section *Rhizirideum* (G. Don) which includes all the *Alliums* with a persistent rhizome, *A. ramosum* and *A. tuberosum* among them. A provisional survey suggests the restriction of the name *Rhizirideum* to the rhizomatous *Alliums* with membranous tunics grouped around *A. senescens*, the revival of section *Anguinum* (G. Don) Vvedensky for the fibrous-tuniced broad-leaved *Alliums* with protruding stamens and rounded seeds typified by *A. Victorialis* and the exclusion from it of *A. ramosum* and allies to form a new section *Butomissa* (Salisbury, Genera of Plants, 91 as a genus: 1866) characterised inter alia by fibrous bulb-tunics linear leaves, more or less included stamens interfused near the base and flattened seeds. But subdivision cannot end here.

The species which come near to *A. ramosum* and *A. tuberosum*, may conveniently be called the "*A. odorum* group." These are *A. fasciculatum* Rendle in Journal of Bot. 44. 42 (1906), syn. *A. Gageanum* W. W.

¹⁰ Lévêillés' description of the pedicels and filaments as puberulous seems to be erroneous.

¹¹ The type-specimen of *A. jalvanum* (Komarov 380, from near the river Yalu north Korea) was referred by Komarov to *A. odorum* but is said by Nakai to differ in having chartaceous not reticulately fibrous bulb-tunics.

Smith in Records Bot. Survey Ind. 4. 247 (1911), with the base of the stem hardly thickened at all and its usual storage function taken over by short tuberous roots; *A. humile* Kunth, Enum. Pl. 4. 443 (1843), syn. *A. Govanianum* Wallich ex Baker in Journal of Bot. 12. 293 (1874), with very short stamens; *A. oreoprasum* Schrenk in Bull. Sci. Acad. Imp. St.-Pétersb. 10. 354 (1842); and *A. weichanicum* Palibin in Acta Horti Petrop. 14. 143 (1895).

Allied to this group is a group of species which Regel, All. Mon. 165 (1875), and other authors have referred to *A. tataricum* Linn. fil. Apparently no type-specimen of *A. tataricum* now exists; judging from the younger Linnaeus's description, based on a plant cultivated at Uppsala, it is *A. ramosum* Linn. The central and west Asiatic species with rose flowers commonly known as "*A. tataricum*" should be called *A. inderiense* Fischer ex Bunge in Goebel, Reise Stepp. Russlands 2. 311 (1938),¹² syn. *A. diaphanum* Janka in Linnaea 30, 606 (1860). *A. Beckerianum* Regel, Index Sem. Horti Bot. Petrop 1860 p. 30, *A. tataricum typicum* Regel, All. Mon. 179 (1875), and is illustrated

¹² C. C. T. Friedemann Goebel, Reise in die Steppen des südlichen Russlands (Dorpat, 1837-38) is a work rarely available in botanical libraries but contains on pp. 247-332 of vol. 2 an "Index Planatarum in Deserto Caspio atque Regionibus prope adjacentibus observatarum" by Carl Claus with the help of Ledebour, C. A. Meyer and Bunge. The name *A. inderiense* appeared as a nomen nudum in F. E. L. Fischer, Cat. Jard. Gorenki 10 (1812) and again in Roemer & Schulties, Caroli a Linne, Syst. Veg. 7. II 1133 (1830) but the first description was supplied by Bunge in Goebel's work:—

"*A. Inderiense* Fisch. MS. (Roem. et Schult. VII. 2 p. 1122 § 10) A: staminibus lanceolatis simplicibus perigonium aequantibus, umbella capsulifera, spatha univ-
ersali abbreviata membranacea apice fissa, caule basi folioso, foliis canaliculatis
linearibus, bulbo obliquo reticulato. Hab. in montibus ad lacum Inderiensem, in
monte Bogdo. Floret Majo, Junioque.

Rhizoma obliquum, radicibus fibrosis sordide albis tectum; bulbus ovato ob-
longus, gracilis, dense reticulatus reticulis tenerrimis fuscentibus. Caulis pedalis
et ultra teres, basi foliosus. Folia plerumque quatuor basi vaginantia; vagina
striata; linearia, basin versus canaliculata 4-5 pollices longa, obtusiuscula, Spatha
univalvis ante anthesin clausa subacuminata, demum irregulariter rupta, reflexa
membranacea. Umbella florens subcapitata sub 20- flora, pedicellis abbreviatis
demum perigonio aequalibus. Flores rosei. Perigonii lacinae 3-4 lineas longae
lineam latae, erectae; externae paulo latiores, subcarinatae, acutiusculae; internae
angustiores oblongo lanceolatae, acuminatae. Stamina tria exteriora subulata, basi
parum dilatata, interiora basi latiora lanceolato-subulata, omnia perigonium
aequantia, vel parum longiora. Antherae fuscentes oblongae. Stylus perigonium
aequans. Capsula triquetra obovata. Semina generis (Bge)."

The type-locality of *A. inderiense* is in south-west U.S.S.R., Uralsk district, near the Inderskoje lake (the Inderskscher Salzsee or Indersk-Sea of German writ-
ers) about 48° 32' N, 51° 50'-52° E, about 100 miles north of the Caspian Sea and 350
miles east of Sarepta (48° 32' N, 44° 30' E), the type-locality of *A. Beckerianum*
Regel and *A. diaphanum* Janka. *Eremurus inderiensis* (M. Bieb.) Regel takes its
name from the same region: Tauscher collected plants and insects there in 1806
on behalf of Fischer's employer, the Russian count A. K. Razumovsky. With the
exception of *Triglossum* and *T. bambusinum*, all the new names (e. g. *Allium in-*
deriense, *A. virescens*, *A. oroprasum*, *A. albidum*, *A. decipiens*, *A. cinereum*) appear-
ing in Fischer's Catalog du Jardin des Plantes de son Excellence Monsieur le Conte
Alexis de Razoumoffsky à Gorenk: (Moscow, 1812) are nomina nuda and not
validly published there.

in *Acta Horti Petrop.* 40. 360 fig. 180 (1929). The group typified by it may conveniently be called the "*A. inderiense* group." Following A. Vvedensky in Komarov, *Fl. URSS* 4. 124-126, 156-162 (1935) this comprises the following:—*A. Barsczewskii* Lipcky in *Acta Horti Petrop.* 18. 114 (1900), illustrated in Regel, *Turkestanaya Fl.* 1 (*Izvyest. Imp. Obshchest Lyubitel. Estest., Antropol; Etongraf., Moskva* 21. II) pl. 14 figs. 1-5 (1876) as "*A. tataricum* L. *typicum*"; *A. dolichomischum* Vvedensky in *Sched. Herb. Fl. Asiae Med.* no. 606 (1935), Komarov, *Fl. URSS* 4. 160 pl. 166 fig. 1 (1935); *A. dolichostylum* Vvedensky in *Bull. Univ. Asie Cent.* 19. 120 (1934); *A. drepanophyllum* Vvedensky in *Bull. Univ. Asie Cent.* 19. 120 (1934); *A. inconspicuum* Vvedensky in *Notulae Syst. Herb. Hort. Bot. Reipubl. Ross.* 5. 93 (1924); *A. longiradiatum* (Regel) Vvedensky in *Povov, Opredel. Rast. Okrest. Taschkent* 1. 67 (1923) and in *Sched. Herb. Fl. Asiae Med.* no. 60 (1925) in *Bull. Univ. Asie Cent.* 9. suppl. 8 (1925), syn. *A. tataricum* B. *longiradiatum* Regel, *All. Mon.* 180 (1875); *A. lutescens* Vvedensky in *Sched. Herb. Fl. Asiae Med.* no. 610 (1935), Komarov, *Fl. URSS.* 4. 159 (1935); *A. stephanophorum* Vvedensky in *Notulae Syst. Herb. Hort. Bot. Reipubl. Ross.* 5. 94 (1924); *A. tenuicaule* Regel in *Acta Horti Petrop.* 10. 348 pl. 4 fig. 4 (1887), reimpr. in Regel, *Allii Sp. Asiae Cent.* 70 pl. 4 fig. 4 (1887); and *A. xiphopetalum* Aitchison et Baker in *Trans. Linn. Soc. Bot.* 2nd ser. 3. 118 pl. 48 (1888).

The following is a key to these two groups, the contrasts from 8A onwards being adapted from Vvedensky in Komarov, *Fl. URSS* 4. 124-126 (1935):—

- 1A. Leaves almost basal, all parting from the stem at about the same level. Flowers starry or open campanulate, mostly white. (*A. odorum* group; genus *Butomissa* Salisb.)
- 2A. Tepals (perianth-segments) rose.
 - 3A. Tepals acuminate, 5-6 mm. long, 3-4 mm. broad. Central Asia *A. oreoprasum* Schrenk.
 - 3B. Tepals blunt, 8-9 mm. long, 2.5-3 mm. broad. North China (prov. Chihli) *A. weichanicum* Palibin
- 2B. Tepals white, usually with a green or purplish red dorsal mid-vein.
 - 4A. Tepals 5-6 mm. long, 3-4 mm. broad, i.e. less than twice as long as broad. Inner filaments nearly 2 mm. broad towards the base, about twice as broad as the outer filaments. Central Asia (Dzungaro-Tarbagatai, Pamir-Alai and Tien Shan floristic regions of U. S. S. R.; Tibet) *A. oreoprasum* Schrenk¹³
 - 4B. Tepals twice to three times as long as broad. Filaments subulate, almost of equal width.
 - 5A. Perianth fairly large; tepals 6-11 mm. long. Stamens $\frac{1}{4}$ to $\frac{1}{2}$ the length of the tepals.

¹³ In a living state the tepals of *A. oreoprasum* are pinkish with a marked dirty purple mid-vein (fide Vvedensky); in a dried state they often appear white or whitish; hence the inclusion of *A. oreoprasum* twice in this key.

- 6A. Leaves somewhat fistulose. Tepals acute. Stamens $\frac{1}{2}$ the length of the usually 9-11 mm. long, 2-3 mm. broad tepals. Capsule broadest at or below the middle. Central Asia.
A. ramosum Linn.
- 6B. Leaves flat. Tepals blunt. Stamens $\frac{1}{4}$ to $\frac{1}{3}$ the length of the 6-9 mm. long, 1.5-2.5 mm. broad tepals. Capsule broadest above the middle. West Himalaya (Kashmir, Simla, Garhwal).
A. humile Kunth.
- 5B. Perianth smaller; tepals 4-7 mm. long. Stamens almost equaling the tepals in length.
- 7A. Stem-base covered with finely interwoven fibres. Roots long and slender, in a dry state usually about 1.5 mm. (rarely 3 mm.) thick. Tepals narrowly ovate (usually about 4-5 mm. long, 2-2.5 mm. broad). South-east Asia, from Japan to India, cultivated as a salad crop.*A. tuberosum* Rottler.
- 7B. Stem-base covered with loose parallel coarse fibres. Roots short and tuberous, in a dry state about 4 mm. thick. Tepals lanceolate (about 4 mm. long, 1 mm. broad). Tibet, Sikkim.
A. fasciculatum Rendle.
- 1B. Leaves separated from one another, parting from the stem at intervals of (0.5-) 1-4 (-5) cm. Flowers campanulate or narrowly campanulate, mostly rose or purplish with the tepals lanceolate, acuminate, persistent, becoming papery, erect and clasping the capsule. Central Asia (Pamir-Alai and Tien Shan floristic regions of U. S. S. R. unless otherwise stated below; cf. *A. inderiense*, *A. xiphopetalum*). (*A. inderiense* group).
- 8A. Ovary with small teeth at the apex, forming a small crown around the base of the style.
- 9A. Tepals dirty purple, unequal, the outer $\frac{1}{4}$ longer than the inner. Pedicels unequal, at first $\frac{1}{2}$ the length, equalling or slightly longer than the (6-) 8-12 mm. long perianth, in fruit sometimes twice the length of the perianth.
A. stephanophorum Vved.
- 9B. Tepals beautiful dark rose, almost equal. Pedicels almost equal, 1-4 mm. long, $\frac{1}{2}$ the length (or less) of the 8 mm. long perianth.*A. tenuicaule* Regel.
- 8B. Ovary without small teeth at the apex.
- 10A. Filaments equalling or slightly longer than the 7-10 mm. long perianth. Style (especially in fruit) protruding.
- 11A. Umbel hemispherical or almost globose, rarely fastigate; pedicels equalling or $1\frac{1}{2}$ (to twice) the length of the perianth. Anthers yellow.*A. dolichostylum* Vved.
- 11B. Umbel fastigate, rarely hemispherical; pedicels $\frac{1}{2}$, equaling or (in fruit) $1\frac{1}{2}$ times the length of the perianth. Anthers violet. Southwest and central Asiatic U. S. S. R. (Lower Volga, Upper Tobel, Aral-Caspia and Balkhash floristic regions).*A. inderiense* Fischer.
- 10B. Filaments $\frac{1}{4}$ - $\frac{2}{3}$ the length of the perianth. Style (even in fruit) not protruding.

LITTLE KNOWN ALLIEAE OF SOUTHWESTERN NORTH AMERICA

J. C. TH. UPHOF

Among the Allieae there are a number of genera that are little known. In southwestern North America these include *Muilla*, *Milla*, *Androstephium*, *Behria*, *Pharium*, and *Diphalangium*. In most cases these genera are monotypic, and the species have received little attention. They are rarely found in collections of living plants, but they are represented as a rule by dried specimens in the larger herbaria.

These genera are so closely related that K. Krause,¹ for instance, placed *Androstephium* with the genus *Pharium* (*Bessera*).

A few of the species have been illustrated. Cavanilles has given us in his beautiful folio work² an excellent plate of *Milla biflora*. Herbert³ and Lemaire⁴ have provided good illustrations of *Pharium elegans*.

These species are distributed in southwestern North America.

Some of the species under consideration produce very beautiful flowers and deserve a place in our plant collections.

In the following pages the writer gives a brief review of the genera and species, and something about their history together with complete descriptions.

1. Genus MUILLA S. Watson

Bulbous plant similar to *Allium*; leaves narrow, linear, flat to terete; Scape simple, leafless, broadened toward the base; flower-cluster an umbel, composed of few to 40 or more small flowers; inflorescence subtended by 3 acuminate scarious bracts that are already distinctly formed in the bud, or may be overlapping or connate at the base; pedicels thin, often slender, subtended by small membranous bractlets; flowers composed of 6 segments, similar in appearance, free or slightly united at the base, subrotate, persistent; stamens 6, adnate near the base of the perigone; filaments filiform (in *M. martima*) or greatly dilated (in *M. coronata*); anthers ovate to elongated; ovary 3-celled, ovules many 8-10) in each cell; style short, clavate, persistent; stigma thick; fruit a capsule, globose, 3-angled, containing many small compressed, angled, black seeds. The herb does not have the flavour or odor that is characteristic to the onion.

¹ K. Krause. Liliaceae in Engler & Pranti. Die Natuerlichen Pflanzenfamilien. 15a: 324. 1930.

² *Ant. Josephii Cavanilles*. Icones descriptiones plantarum quae out sponte in Hispanica crescent out in horti hispanitur. 2: t.196 Matriti 1791-1801.

³ *William Herbert. Pharium fistulosum*. Edward's Botanical Register. T.1546, 1832.

⁴ *Ch. Lemaire. Bessera miniata*. Flore des Serres et des Jardins de l'Europe. T. 424, 1848.

At present six species of *Muilla* are known, and these are described below.

Notes.—The original description of this genus is entirely bound up in the morphological description of *Hesperoscordium ? maritimum*, as originally described by Torrey as a doubtful species in 1856.⁵ In 1871 it was named *Milla maritima* by S. Watson,⁶ who later on renamed it *Muilla maritima*⁷ in 1879. He gives here a description of the species, mentioning some of the synonyms, but gives no description of the genus itself. Watson apparently recognized the plant from the description given by Torrey. It is clear that the name *Muilla* is an anagram of *Allium*, the name being spelled backward.

1. *MUILLA CORONATA*, Edw. Greene, Misc. Species, New or Rare, Pittonia 1: 165, 1887-1889; W. L. Jepson, A Manual of the Flowering Plants of California. 223, 1923.

Description.—Bulb 15 to 18 mm. in diameter, developing about 2.5 cm. below the surface of the ground; leaves 2 to 3, narrow, linear, double the length of the scapes; scape 3.5 to 5 cm., sometimes 10 cm. high; umbels 3 to 10 flowered; perigone rotate, segments 3 to 4 mm. long, pale blue to nearly white within, green with bluish margins on the inside; segments of the perigone are characterized by a narrow white scarious border; filaments hyaline, petaloid, retuse at the apex, broadly oblong; anthers sub-sagitate, erect, fixed at about the middle to the abrupt incurved median point of the petal-like filament.

Notes.—The type specimen was collected by the western pioneer Dr. C. C. Parry who collected the plant late in March 1888 in the Mohave Desert. Greene compares the color of the flowers with those of *M. transmontana*, Greene, adding “the filaments taking an unexpected phase, their broad margins overlapping, though wholly distinct, thus forming as it were a cylindrical cup or crown, from the orifice of which the yellow anthers are exerted a little less than half their length.”

2. *MUILLA TRANSMONTANA*, Edw. Greene, Misc. Species, New or Rare, Pittonia 1:73, 1887-1889; Ivar Tidstrom, Flora of Utah and Nevada, Contrib. U. S. Nat. Herb. 25:;22, 1925.

Description.—Bulb 2.5 to 3 cm. or more in diameter; scape 30 cm. or less in length, fusiform-enlarged; umbel 12 to 30 flowered; pedicels 2 to 3 cm. long; perigone rotate, white, fading with a tinge of lilac; segments 6 mm. long; filaments petal-like, white, ovate-acuminate, relatively thick and fleshy, the margins grown together at the base, forming a shallow nectar-containing receptacle around the ovary; anthers about 1 mm. in length.

⁵ John Torrey. Description of the General Collections. Rep. Explor. and Surv. Pac. Railr. 4: nr. 4, 148-149, 1856.

⁶ Sereno Watson. Botany: U. S. Geol. Explor. Fortieth Parallel. Clarence King, Geologist-in-Charge. 5:354-355, 1871.

⁷ Sereno Watson. Contributions to American Botany. Proc. Am. Acad. Arts & Sciences. 14:235, 1879.

Notes.—Greene states that this species is very clearly distinct from *M. maritima* (Torr.) Wats. stating that the flowers vividly suggest “the idea of a generical affinity with *Hesperoscordium* Lindley; but the inarticulate pedicels of *Muilla* forbid the suggested union of this genus and that section of *Triteleia*.”

This species was described from Reno-Nevada, from fresh specimens that were communicated by Miss Amy Pease.

3. *MUILLA MARITIMA*, (Torr.) S. Watson, Contrib. to Amer. Botany, Proc. Am. Acad. Arts and Sci. 14:235, 1879; W. J. Jepson, A Manual of Flowering Plants of California, 222-223, 1923; *Hesperoscordium ? maritimum*, John Torrey, Description of the General Botanical Collections. Reports, Explorations and Surveys. Pacif. Railr. 4 : nr. 4, 148-149, 1856; *Allium maritimum*, G. Bentham, Plantae Hartwegianae. 339, 1857; *Nothoscordum maritimum*, J. D. Hook., Curtis' Bot. Mag. under descr. of plate 5896. vol. 27, 1871; *Milla maritima*, S. Watson, Botany; United States Geological Exploration of the Fortieth Parallel. Clarence King, Geologist-in-Charge. 5:354-355, 1871.

Description.—Bulb 1.5 to 2 cm. in diameter, fibrous-coated; scape 7 to 22, sometimes 30 cm. high; leaves narrowly linear, almost terete, about as long as the scape; umbel 4 to 12 flowered; pedicels 0.6 to 2.5 cm. long, the lower pedicels frequently 2-4, sometimes 5 cm. long, the others much shorter; bracts 4-6, subulate-linear, connate at the base; perigone segments 4 to 6 mm. long, acute to obtuse, the petals generally wider than the sepals; the midnerve broad thickened, brownish, margins greenish-white; filaments filiform, inserted a little above the base of the segments, not connected; anthers oblong, yellow or pale purple; ovary ovate, obtuse; style filiform, erect, slightly clavate upward, stigma minutely 3-cleft.

Notes.—On saline fields, Sacramento Valley and Marin Co., California. Torrey, who seems to have been in doubt as to the exact affinity of this species, states “It differs from *Hesperoscordium* in the petals being distinct nearly to the base, and in the slender filaments.” The original plant came from the sea shore, Punta de los Reyes, California, and belonged to the greater part of the botanical collections made by Dr. J. M. Bigelow, in the Pacific Railway Survey, under the charge of Captain Whipple and were submitted for examination to John Torrey in accordance with the instructions of the War Department.

4. *MUILLA SEROTINA*, Edw. Greene, Novitates Occidentales IV: Erythraea 1 : 152, 1893; W. L. Jepson, A Manual of the Flowering Plants of California. 223, 1923; Le Roy Abrams, Flora of Los Angeles and Vicinity. 85, 1904.

Description.—Bulb 1 to 1.5 cm. in diameter; leaves 30 to 40 cm. in length, subterete, the upper-side almost flat, only slightly concave; the lower surface convex and distinctly 7-striate; scape 35 to 50 cm. high; umbels 10 to 20, in some instances as much as 40-flowered, (Greene records 70-flowered), glabrous, glaucous; pedicels about 5 cm. long (?); perigone rotate, 1.5 cm. broad, dull-white; broad green veins branch to

the segments; sepals oblong-linear, petals oblong; filaments stout-subulate, slightly compressed; anthers 1 mm. long, pale purple.

Notes.—This species is found in the mountains and half-open foothills, in the upper Joaquin Valley. Plants are especially common in the mountains and toward the interior of Southern California. Le Roy Abrams states, in his *Flora of Los Angeles*, that the plants are frequent in dry stony places in the plains and foothills. Green says that under cultivation in Berkeley plants flower in June and July, whereas *M. maritima* flowers in March and April.

5. *MUILLA TENUS*, J. W. Congdon, *Some California Plants*, Zoe 5: 135, 1901.

Description.—Bulb 1.5 cm. in diameter, growing about 2 to 3 cm. deep in the soil; stem very slender, 15 to 30 cm. high, having a membranaceous sheath around the base; leaves 6 to 15 cm. long, filiform; umbel 12-15 flowered; pedicels 2 to 2.5 cm. long, slender; bracts around the umbel 4 to 6, long-acuminate, 3 to 10 cm (?) long; flowers whitish, 4 mm. in diameter; sepals oblong, somewhat obtuse, the broad midvein slightly yellowish-brown; filaments filiform, anthers versatile, ovate; capsule depressed-globosed, somewhat 3-lobed; seeds flattened, irregularly angled, few in number.

Notes.—This species, which is closely related to *M. maritima* of which it may be a variety, is distinguished from it, by its extreme slenderness of all its parts, and by its different sepals.

This species was first reported from California, foothills, Raymond, April.

6. *MUILLA PURPUSII*, T. S. Brandege, *Plantae Mexicana Purpusianae*, III, Univ. of Calif. Pub. in Botany. 4: nr. 11, 177 1911.

Description.—Bulb 1.5 cm. in diameter, tunicate; scape hispid at the base, about 2 dm. long; leaves filiform; umbel bracteose at the base; pedicels about 3 cm. long; perigone-segments 9 mm. long, oblong-lanceolate, margins bluish; flowers rotate, bluish with green in the center of the perigone-segments; tube short; filaments bluish, anthers oblong; capsule with 3 to 5 seeds in each cell.

Notes.—This species was first collected on Sierra de la Paila, Coahuila, Mexico. no. 4959 Type Herb. Univ. Calif. no. 148555. In the U. S. National Herbarium, I observed a specimen from Limon Mt., Guerrero, Mexico, alt 1200 meters.

2. Genus *MILLA* Cavanilles

Bulbs small, tunicate; leaves few, narrow; perianth 6-lobed, funnel-shaped; tube cylindric, narrow; anthers 6, filaments short, inserted at the apex of the tube of the perianth; filaments short; anthers of equal size, nearly the same length of the style; style filamentous, stigma slightly lobed; ovary superior, elongated; fruit a capsule, membranaceous, obtuse; seeds many; compressed; seed-coat black.

About thirty years after the description by Cavanille,⁸ it was apparently listed by Rafinesque under the names of *Askolame*,⁹ *Ipheion*¹⁰ and *Tulophos*¹¹. Only one species is recognized at present. Cavanille named this genus in honor of Juliani Milla of Madrid, Spain, stating: "In honorem D. Juliani Milla Regii horti matritensis primarii hortulani."

1. *MILLA BIFLORA* Cav. Icon. descr. Hisp. 2:76, T. 196, 1791-1801. Torrey in: Rept. U. S. and Mex. Bound. Surv. 2:219, 1859. *Description*.—Bulb subglobose, small; scales light brown. Leaves 15 to 20 cm. long and 3 to 4 mm. wide, linear, acute, green, glabrous. Scape 2 to 4-flowered, seldom bearing one flower, as long as the leaves, round. Spathe-valves small, lanceolate, acute. Flowers white, funnel-shaped, 6-lobed; lobes oval; tube small, narrow, cylindric. Stamens much shorter than the perianth; filaments very short, inserted on the apex of the tube. Ovary cylindric, becoming narrower at both ends; style filamentous; stigma slightly lobed. Capsule membranous, elongated, 6-parted; seeds many, flattened, black.

Notes.—Native to Mexico and Guatemala. Cavanille observes that his specimen came from Mexico, stating: "Habitat in Imperio Mexicano, vivi floridam et fructiferam mense Octobris in regio horto Matritense." John Torrey states that his plant resembles Mexican specimens collected by Dr. Halsted and others.

3. Genus ANDROSTEPHIUM Torrey

Bulbous plants. Scape forming an umbel. Flowers pedicellate. Perianth funnel-shaped, 6-lobed, regular; tube narrow. Stamens 6; filaments inserted on the tube; anthers bilocular, introrse. Ovary sessile, oblong, 3-celled, with 12 to 14 ovules; style filiform; stigma 3-lobed. Capsule obovate, truncate, 3-lobed. Seeds 8 to 14 in each section, compressed, black.

John Torrey¹² states that the Mexican genus *Bessera* most resembles *Androstephium*, but it differs in the very short tube of the perianth, in the tube of the filaments, having only a short tooth between the filaments, and in the form of the capsule.

1. *ANDROSTEPHIUM COERULEUM* (Scheele) Greene, Pittonia 2:57. 1890; Morton, HERBERTIA 7:77-78. 1941; *Milla coerulea* Scheele, Linnaea 25:260. 1852; *Androstephium violaceum* Torr. Bot. Mex. Bound. 219. 1859. *Description*.—Bulb globose, outer scales brown. Leaves linear, 15 to 20 cm. long and 2 to 4 mm. wide. Scape of the same length as the leaves, round, stout, terminating in a 2 to 7-flowered umbel. Flowers have a faint sweet scent. Spathe-valves 3-nerved, scarious,

⁸ *Ant. Josephii Cavanilles*. Icones descriptions plantarum que out sponte in Hispanica crescent out in horti hispanitur. 2:76, Matriti 1791-1801.

⁹ *C. S. Rafinesque*. Flora Telluriae. 2:11, 1836.

¹⁰ *C. S. Rafinesque*. Flora Tilluriae. 2:12, 1836.

¹¹ *C. S. Rafinesque*. Flora Tilluriae. 3:71, 1836.

¹² *John Torrey*. in: William H. Emory. Report of the United States and Mexican Boundary Survey. Vol. II Botany of the Boundary. 218, 1859.

lanceolate, acuminate. Pedicels usually shorter than the flower. Perianth violet, 2 to 2.5 cm. long, 6-cleft to the middle; segments oblong, obtuse, spreading. Stamens 6; filaments united into a tube, arising from the orifice of the perianth, being conspicuously exserted, forming between and beyond the anthers into a crown of 6 oblong emarginate lobes. Anthers linear-oblong. Style of the same length as the stamens. Ovary free. Capsule sessile, having 3 prominent laterally compressed cells. Seeds suborbicular, compressed, narrowly winged.

Notes.—Native to Texas and adjacent Mexico. Was observed by John Torrey originally on hills and prairies on the rivers Blanco and Colorado, Texas. He states: "We have excellent specimens from Dr. R. Gleason, United States Army, collected near Fort Arbuckle, and it occurs in Lindheimer's Texas Collection fasc. IV."

4. Genus BEHRIA Greene

Perianth tubular, abruptly subglobose and 6-lobed above the attenuate base, afterward becoming contracted into a long, narrow, 6-toothed tube. Stamens 6; filaments free toward the base of the tube of the perianth where they are abruptly dilated and united into a short crown. Ovary superior, 3-celled; ovules many; style long exserted, filiform, terminated by a small, 3-lobed stigma.

Greene¹³ dedicated this genus to his friend H. Herman Behr, M. S. Professor of Botany in the College of Pharmacy of the University of California. One species is known.

1. BEHRIA TENUIFOLIA Greene. Bull. Calif. Acad. Sci. 2:143-144, 1887. *Description.*—Bulb ovoid. Leaves linear, 2 to 4. Umbel 8 to 17 flowered; pedicels very slender, 2 to 5 cm. long. Perianth 20 mm. long; tube 6 mm. wide. Lobes of the perianth ovate-oblong; spreading, bright scarlet. Anthers linear oblong, 2 mm. long, obtuse at each end. Capsule ovate, 1 to 1.5 cm. long.

Notes.—Greene states that the original specimen was labeled San José del Cabo which means that it was found near Cape St. Lucas or thereabouts, however, the name of the collector is unknown, "the fragments have been lying in the herbarium of the Academy for many years."

5. Genus PHARIUM Herbert

Pharium Herbert, Bot. Reg. 18: pl. 1546. 1832; Morton, HERBERTIA 4: 102-103. 1937; syn. *Bessera* Schultes f. *Linnaea* 4: 121. 1829.

Bulbous plants. Leaves lanceolate. Flowers united into an umbel. Perianth bell to funnel-shaped. Lobes united at the base to form a small tube. Stamens 6, longer or almost as long as the perianth. Lower part of the filaments united to the tube. Ovary superior, cylindric, tapering

¹³ Edw. L. Greene. Studies in the Botany of California and parts adjacent. Bull. Calif. Acad. Sci. 2:143-144, 1887.

slightly at both ends; style filiform; stigma slightly 3-lobed. Capsule ovoid, 3-ribbed. Seeds many, compressed.

Schultes who gives a lengthy description of this genus states that it was dedicated to Prof. Besser¹⁴—"Genere Besserae a patre olim condito non recpto, Besseraque Sprengelii nunc ab ipso auctore ad Drypetem et Rumean amandata, novam inde constitui Besseram in honorem D. D. et Prof. Besser, patris mei amici optimi, et de rebus botanicis, ut libi omnibusque Botanicus notum, optime promeriti."

1. PHARIUM ELAGANS (Schult.) Steud. ex Morton, HERBERTIA 4: 102-103. 1937; syn. *Bessera elegans* Schult. in Linnaea 4:121-127, 1829; *Pharium fistulosum* Herb. in Edw. Bot. Reg. T. 1546, 1832; *Bessera multiflora* Mart and Gal. Bull. Acad. Bras. 9, 1842; *Bessera miniata* Lem. in Flore d. Serres. T. 424, 1848; *Pharium elegans* Steud. Nom. Ed. II, 2, 316; *Pharium Herbertii* Stud. Nom. Ed. II, 2, 316.

Description.—Bulb small, subglobose, tunicate, membranous, brown. Leaves 2 to 3, about 10 to 16 cm. long, 3 to 4 mm. wide, linear, acute, glabrous, fistulose, attenuate, canaliculate, often reddish at the base. Scape of the umbel 5 to 12-flowered; about as long as the leaves, cylindrical, glaucous, reddish toward the base. Spathe-valves small, acute. Pedicels slender, 3 to 4 cm. long, green often reddish below the flower. Flowers more or less pendulous, bell to funnel-shaped; lobes of the perianth ovoid to lanceolate, reddish-purple; tube very small, turbinate. Stamens as long or slightly longer than the perianth. Anthers small oval; filaments slender; the base being connected with the tube of the perianth. Ovary cylindric; style filiform; stigma 3-lobed.

Notes.—Native to Mexico. William Herbert who described this plant under the name of *Pharium fistulosum*, states that this little bulbous plant flowered in the Greenhouse at Spofforth in September, having been imported from Mexico by Mr. Tate of the Sloane-Street Nursery, Chelsea. He observes, "It will be an interesting plant to the Botanist. The cup which connects its filaments seems to furnish a link between *Asphodelae* and *Amaryllidae*." He calls this species *Hollow-leaved Pharium*.

6. Genus DIPHALANGIUM Schauer

Perianth hypocrateriform, actinomorphic; limb 6-lobed; tube cylindric. Stamens 6, inserted on the tube of the perianth. Anthers bilocular, introrse. Ovary superior, 3-celled with many ovules; style filiform; stigma 3-lobed. Capsule 3-ribbed, many seeded.

Schauer¹⁵ who proposed this genus, considers it closely related to *Tristigma* and *Milla*. He placed it in the "Subordo Agapanthae" of the "Ordo Liliaceae." Only one species is known at present.

¹⁴ *Jul. H. Schultes, D. F. L. de Schlechtendal. S. P. D. Bessera elegans. Genus novum Hexandrae monogynae. Linnaea 4:121-127, 1829.*

¹⁵ *S. Schauer. Enumeratio descriptiones generum novarum specierum que plantarum in terris mexicanus crescentium. Linnaea 19:702-703, 1847.*

1. *DIPHALANGIUM GRAMINIFOLIUM* Schauer in *Linnaea*. 19:702-703, 1847. *Description*.—Bulb round; tunic fuscate. Leaves linear, canaliculate. Perianth 6-lobed, funnel-shaped; tube cylindric; lobes laciniate. Stamens 6; part of the filaments inserted on the perianth tube. Filaments very short; anther-sacs linear-oblong. Ovary ovate, 3-celled, containing many ovules. Fruit a capsule; 3-ribbed, many seeded.

Notes.—Native to Mexico.

DAYLILY CHECK-LIST —ANNOUNCEMENT

The first draft of a Daylily Check-List was prepared by Dr. L. H. MacDaniels before he left for the Near East in 1943. The work of completing the Check-List has fallen on the shoulders of *Prof. J. B. S. Norton, 4922 40th. Place, Hyattsville, Maryland*.

Up to the present about 1000 daylily clones have been described in the literature and it is necessary to have an easily accessible check-list in order to obviate duplication of names. This list will be published in *HERBERTIA* as soon as completed.

All persons interested in the future of the daylily as a garden subject are requested to cooperate with Prof. Norton so as to make the check-list complete and thus of maximum usefulness. Daylily breeders and introducers should send to Prof. Norton, if complete information is not now accessible, a complete list of clones together with the following information—

(a) Date when the clone was first described in a recognized publication (book, periodical, trade catalog, mimeographed list, etc. All of these should be dated). Exact volume and page reference should be given, and date of publication. If possible copies of trade catalogs, mimeographed lists, etc., should be furnished.

(b) If a good illustration has been published of the clone, an exact reference to it should be furnished.

(c) If there are any other names, synonyms, for the clone, these should be indicated, together with exact references. If it has been confused with other clones this information should be included.

(d) The originator, and the introducer of the clone should be indicated.

Such information as indicated above will greatly assist Prof. Norton, and speed up the final checking of the list.—*Ed.*

REGIONAL DAYLILY TEST GARDENS

PROF. JOHN V. WATKINS,
University of Florida, Gainesville

Consistent with the policy of full collaboration with the five Regional Test Gardens, the University of Florida sent out twenty-nine different plants of *Hemerocallis* on November 4, 1944. These plants were all varieties which were originated by Dr. Hamilton P. Traub. In the past it has been the policy of the University of Florida to send three plants of each variety, but in order to disseminate the new originations as quickly as possible, it was necessary, this season, to limit each garden to a single division of each variety.

RATING OF HEMEROCALLIS

GEORGE GILMER, *Virginia*

We need a good system for rating daylilies generally. The American Amaryllis Society has published several times a list of ten or twelve best. To get on that list daylilies had to be *good* and *widely* distributed. The *excellent* daylilies with limited distribution had no chance. Judges were asked to list their ten favorites. They were rated according to the number of lists including the variety without regard to their position on the list. To illustrate, a variety named Cream might be at the bottom of one on thirty lists, and rated top. Pink Rose might be top on fifteen lists and yet not included in the ten best.

There should be a definite number assigned to each variety and those averaged to rate a variety, with only a tentative rating assigned to those receiving less than ten votes. Judges should be careful not to be unfair to any variety by rating an immature plant. It might be suggested that five to ten percent of a grower's best varieties be rated at 90 or better, and that those without sufficient quality to be replaced if destroyed should be rated at 65 or less. A rating of 65 or less would indicate that the plant should be discarded. Fair plants worth keeping because available from many commercial growers at low cost should be rated at 65 to 79, good plants 80 to 89, with outstanding plants 90 to 100. None but the best should be rated 95 or better. Such a system would accurately indicate what a grower might expect from a plant, although he might be personally inclined to rate it slightly above or below the average.

No rating system is perfect but a person could rely on such a system in buying plants that he had never seen and be satisfied with nine out of ten purchases. I found this true in regard to peonies and iris. Last Fall I bought twenty-four French lilacs based on a rating of the American Association of Botanical Gardens and Arboretums. I expect to be satisfied with at least twenty-two, possibly more.

I will be glad to assign numerical ratings to fifty or more varieties and send them in this year for tabulation. Some forty daylily enthusiasts could make a list of 50 to 200 varieties each. I doubt if a person

growing less than fifty varieties would have enough experience to make reliable ratings of value to others. Ratings based on such a tabulation would be of big help to me in buying top quality plants. The preparation of such a rating schedule I believe would increase the interest of anyone who would take the trouble to prepare it. There are so many interesting details to be considered, durability, fragrance, color, shape, size of bloom, branching, etc., as well as season of bloom, foliage, vigor, etc.



Figure 123. Hybrid Daylily—*Cherokee Maid* (Introduced 1945 by J. Marion Shull)

CHEROKEE MAID DAYLILY

J. MARION SHULL, *Maryland*

The following pedigree of the *Cherokee Maid* Daylily (Shull, 1944) may be of interest to other daylily breeders.

Hemerocallis serotina (Thunbergii) X *H. fulva Europa*

⋮
Iris Perry X “*Thulva*”

⋮
B-1 (Shull) X *Rajah*

⋮
Cherokee Maid

Cherokee Maid just full blown is a Van Dyke Red self according to Ridgway. The throat is a harmonious deep orange, with the eye zone not conspicuously darker than the petalage. Flower is of good size and form, petals ruffled edged and the sepals recurved at tips (Fig. 123).

The foliage is medium green, leaves broad and arching, the mass reaching a height of slightly more than two feet. Scape tall, to 52 inches, sinuously erect and sturdy with multiple compound branching and a maximum of 53 buds so far reported.

The outstanding characteristics are color novelty, a rich purplish bronze rather than red in mass effect, and the exceptionally large number of flowers per scape.

The color suffers some diminution of richness late in the day but does not burn as so many of the darker varieties do in prolonged hot sun. Nor does the color spot in rain as it does in many of the reds or other dark sorts. Best color is maintained, however, by growing in partial shade.

This is Seedling No. 42-26 referred to by Claar in HERBERTIA for 1942, page 30, as “A sort of raspberry purple.”

HYBRID AMARYLLIS IN KANSAS

GARNALD D. ZEINER, *Kansas*

Hybrid *Amaryllis* that I have named include *Summer Rose*, *Giant Orange*, *Big Chief*, *Deceit*, and *Triple Trest*. These are described and registered elsewhere in this issue.

I have under test various named clones of the Mead Strain as grown by the Commercial Bulb Gardens, Orlando, Florida. *Garnet King* is an almost solid red and although not of the largest size it is satisfactory. *American Beauty* has not bloomed for me although I have had it over a year. *White Star* is the best that I have received from the Florida firm. The flowers are medium in size and are rose white stripe. With me the clone *Pink Tipped* is not tipped pink at all but what I call “frosted.” The ground color is white and between the rose stripes the area can be best described by the word “frosted.” *Exhibition* is a scarlet with a white stripe, small in size and fair form.

I have recently secured *Johnsonii*, apparently the first introduced hybrid *Amaryllis*. From Cecil Houdyshel I am to receive the clone *Sibyl Houdyshel*, and from W. E. Rice, W. M. Campbell, *Lady Helen* and *Zulu*. When these flower I will report further on my *Amaryllis* activities.

HYBRID CRINUM—EDMUND STURTEVANT

CECIL HOUDYSHEL, *California*

I think it was the year 1914, my first year on this Rancho de las Flores, but it could have been a year or so later, that I was advertising Hybrid *Crinum* J. C. Harvey among other items, in the Los Angeles *Times*. One of the results was an inquiry from E. D. Sturtevant, a famed Water Lily specialist of Hollywood, then retired.

Mr. Sturtevant stated that the late J. C. Harvey had been a friend of his and he wished to purchase one of his Crinums. At once, I mailed him one of my finest bulbs, gratis and wrote to him. He replied, thanking me and invited me to visit him and see his own plants and bulbs.

This invitation was promptly taken advantage of. At his home I was met by a very tall, very feeble old man who wore a shawl over his shoulders. But the fires of an intelligent, keen mind and a spirit, that neither age nor physical weakness could daunt, showed from his eyes. Slowly he guided me around his garden, showed me his crinums and other bulbs, plants, greenhouses and the lovely large trees. He told me about his Water Lilies.

Most interesting to me were his crinums. He had a number of *Crinum asiaticum* and *C. Moorei*. Of the latter he had the variety "alba" and one he called "*platypetalum*" or "*platyphyllum*."

The best of all was a hybrid which he had raised by crossing the two species, *C. asiaticum* x *C. Moorei*.

Although these species belonged to different sub-genera, *C. asiaticum* to STENASTER and *C. Moorei* to CODONOCRINUM, and are not very closely related and in the past, thought probably to be sexually incompatible, yet there can be little doubt that Sturtevant had actually crossed them.¹

Three very logical reasons point to this conclusion. The statement of Mr. Sturtevant, a sincere and capable man. He apparently had no other species. The hybrid shows unmistakably the characters of both the Stenasters and Codonocrinums.

Mr. Sturtevant gave me a large bulb of his crinum. It is a good multiplier, but I must admit I have only a dozen bulbs after possessing it thirty years. Once I thought I would lose them all by way of mosaic.

It is unlikely that this crinum has ever been observed by any other amaryllid specialists and I doubt if any exists besides these I have.

I have named this Hybrid *Crinum Edmund Sturtevant* (Fig. 124) in honor of its originator Edmund D. Sturtevant. I hope sometime to introduce it because it is most worthy of cultivation and as a memorial to a most worthy man. May it become common in California gardens and perpetuate his name.

I will leave the botanical description of this to Dr. Traub at a later date. A popular description such as I would use in my catalog would be

¹ The question as to the self —or inter-fertility of the hybrid apparently remains to be answered —Ed.

as follows: "Bulb and plant quite large and similar in appearance to *C. asiaticum*. The bulb is long, with rather more slender neck than *C. asiaticum* and a more definitely expanded bulb. It increases by fission



Figure 124. Hybrid *Crinum*—Edmund Sturtevant (Introduced 1945 by Cecil Houdyshe)

like the seed parent as well as by offsets as in both parents. The flower is of outstanding beauty, 6 inches wide, delicate pink, and sometimes 30 or more in an umbel. The lanceolate petals are horizontal to ascending,

not reflexing like *C. asiaticum*. It has a longer scape than *C. asiaticum* and thus the flowers are well above the foliage as in *C. Moorei*."

I still have the individuals from the reciprocal cross from Mr. Sturtevant but they do not appear to be of horticultural importance.

As I hope that my esteemed friend, Ernest Branton, may at a future date give us a brief biography of Mr. Sturtevant, as well as those of other California pioneer Amaryllid breeders like Harvey and Comperé, I will not attempt to do so.

WHITE AGAPANTHUS CLONE—FRANK MCCOY

L. S. HANNIBAL, *California*

Some time back the writer obtained several species of *Agapanthus* with the thought in mind that there may be possibilities in hybridization within the genus, but he soon learned that climatic conditions were not entirely favorable in Concord, California, for seed rarely set. The cooler areas along the coast are more conducive to pollination than the dry inland temperatures of the central valleys. But in spite of his troubles, interest in the group did not die; in fact it was greatly stimulated when he learned that Mr. Giridlian had produced a hybrid *agapanthus clone*. Further search of the catalogues led to the discovery of the Australian hybrid *Intermedius* whose petals were pure white with a yellow keel. Then out of blue sky he received a note from Frank McCoy saying that he had a seedling plant with large white flowers. Since the white flowered plants that we knew were not larger than the usual blue *A. Orientalis (umbellatus)*, our interest hit a new high. It sounded almost too good to be true.

This fall the writer had the opportunity to be in Santa Maria, and to stay at the beautiful inn that Mr. McCoy operates, a virtual paradise for flower lovers. And if anything, his reports regarding his *Agapanthus* had been very modest, for his collection consists of a great number of seedling plants, many of fine form and substance, but his whites are really exceptional.

His breeding experiments date back to the visit of Miss K. C. Stanford, of Stellenbosch. She sent him some seed of several wild clones that she had growing in her garden at BLOEM ERF. The bees apparently had done a good job of cross pollination as no two seedlings were quite the same. Many turned out to be some shade of blue, but out of the mixture Mr. McCoy selected several fine white clones for propagation. One, a large vigorous plant which he carefully isolated into an inner court of the hotel, bears 12-inch umbels carrying 200-300 white blossoms. Each flower is 2 or more inches across, has relative wide segments, and yellow anthers.

In front of the inn several other large white clones are to be found, but in contrast to the one mentioned above these have black anthers—a condition which apparently is new to us as nothing could be found in the literature regarding black anthers. Both strains have foliage somewhat like that of *A. orientalis*, producing numerous leaves 1½ inches wide by

30 inches long, but a third type worth noting is very distinct as the leaves are only 14 inches long, and are over $2\frac{1}{2}$ inches wide, being very blunt in the tip. All clones are of possible natural or garden hybrid source and any close identification is difficult, but it appears that Mr. McCoy has introduced material that is new to our gardens, and it should be of excellent value for breeding purposes.

The above described clones are not available at present for distribution, but to further activity in the breeding of giant white plants Mr. McCoy has turned over a number of unflowered seedlings to the society. These were grown from selfed seed taken from the giant white with the yellow anthers—A clone which now bears the official name of Frank McCoy. True, seedlings are seedlings, and only a part may prove up, but the society deeply appreciates receiving these plants. Given time and suitable breeding conditions it is apparent that much can be done. *Agapanthus* may possibly rival the daylily in California. The white flowers have particular value, for, during the summer when they are produced, few other white blossoms are available to the cut flower trade. Do you wonder why we are so enthusiastic?

AMARYLLID GENERA AND SPECIES

In this department the descriptions of amaryllid genera and species translated from foreign languages will be published from time to time so that these will be available to HERBERTIA readers.

GENUS HEMEROCALLIS

Hemerocallis Forrestii Diels, Notes Bot. Gard. Edinb. 5:298.1912

Plant 30-45 cm. high. Stem at the base densely surrounded by the fibrous remains of the former leaves. Leaves 20-35 cm. long, 1.3-1.7 cm. wide, obtusely acuminate. Corymb 8-10 flowered, the pedicels 1.5-2 cm. long, the bracts ovate or lanceolate. Flowers reddish-orange, inodorous, the tube short (1-1.5 cm. long), gradually enlarged to the limb, the outer segments oblanceolate, 5.5-6 cm. long, 1-1.5 cm. broad when dry, brownish especially toward apex, the inner equally long, broader, thinner.

Habitat: China, Yunnan Province.

Hemerocallis nana Forrest & Smith, Jour. Roy. Hort. Soc. XLII (I), fig. 12, 1916; Notes Bot. Gard. Edinb. 10:39.1917.

Plant 25-50 cm. high. Stem densely surrounded at base by the fibrous remains of former leaves. Leaves 8-12 cm. long, 4-6 mm. wide, linear, somewhat obtusely acuminate. Flowers solitary or paired, reddish-orange, the peduncle 4-12 cm. long, the pedicels about 1 cm. long, the bracts membranaceous, ovate or linear-lanceolate. Perianth 6 cm. long, more or less, the tube a little exceeding 1 cm., gradually enlarged into the limb; outer segments linear, about 5 cm. long, 4-5 mm. broad, reddish at apex, the inner a little shorter, very thin; immature fruit 1.5 cm. long and about 1 cm. wide when dry.

Habitat: China; Northwest Yunnan.

Hemerocallis esculenta Koidyumi, Bot. Mag. Tokyo, 39:28.1925.

This species is to be compared with *Hemerocallis Thunbergii* Baker, but the perianth is pale reddish-yellow (not pale yellow), the perianth segments oblong (not narrowly oblong), all similar in form (not with the exterior lanceolate, acutish at apex), the tube shorter, the anthers broadly elliptic (not long-oblong), longitudinally white-striate at middle, the connective shorter; the root sometimes tuberous-inflated.

Scape glabrous, 70-90 cm. high, altogether naked, exceeding or sometimes subequalling the leaves. Leaves all basal, 8-13 to a plant, distichously arranged at the base of the scape, 20-90 cm. long, 8-10 mm. wide, linear, acuminate, entire, deep green. Corymbs 3-4-flowered, the bracts and bracteoles scarious, 10-20 mm. long, ovate or ovate-lanceolate, acuminate, the pedicels 10-24 mm. long, the flowers 9.5 cm. long, pale reddish-yellow, funnel-shaped; perianth tube cylindric 2-2.5 cm. long, the lobes 6, oblong, all similar in shape.

Habitat in alpine regions on Mt. Asamayama, Prov. Shinano, Japan, collected by Koidyumi, July 28, 1924.

Genus CYBISTETES Milne-Redhead & Schweickhardt

Jour. Linn. Soc. Lond. Bot. 52: 159-197. 1939

Bulb spheric-ovoid, tunicate, often conspicuously attenuate upwardly. Leaves falcate-ligulate, the 1 to 3 unimpaired young leaves rounded at apex, the older ones always truncate and lacking the apex, distichous, biflabellately disposed, mostly spreading or the younger appressed, gradually withering down to the apex of the bulb after a certain period of time, the same leaves growing again the next season from the base and forming new leaves, the same leaves probably persisting through several seasons, the margins mostly scarious, conspicuously erose. Scape lateral, compressed, solid. Umbel 13-24-flowered, the flowers manifestly serially (centripetally) expanded. Spathe valves 2, persistent, thin coriaceous. Bracts filiform, mostly broadened toward the apex, persistent. Pedicels more or less 3-angular, variable in length, very elongate in fruit, rigid and spreading in every direction. Flowers zygomorphic. Perianth tube often forming an angle with the pedicel, subcylindric, slightly broadened upwardly, obtusely angled. Perianth lobes subequal, very obtusely keeled, much longer than the tube, imbricate below anthesis, gradually spreading at apex, forming with the tube a funnel-shaped perianth, the outer lobes strongly hooded at apex, the interior broader and less hooded, more or less reddish in age. Stamens inserted in the throat of the perianth tube; filaments filiform, strongly exserted from the tube, declined, unequal, the inner a little longer than the outer; anthers linear-oblong, curved, dorsally attached a little below the middle of the connective, versatile. Ovary obtusely angled; ovules 8-18 in each cell, two-seriate, inserted all over the side of the placentae. Style filiform, 3-angled, well exserted, declined. Stigma entire, minutely 3-sulcate, papillose. Capsule indehiscent, club-shaped or fusiform-obovoid, 3-angled, strongly 6-ribbed, the persistent membrane between the ribs irregularly ruptured and withering, thus liberating the seeds. Seeds fleshy,

pale ashy-green, subglobose or obtusely angled, often germinating in the capsule; embryo straight; endosperm copious.

Genus AMMOCHARIS Herb. emend. Milne-Redhead and Schweickerdt, Journ.

Linn. Soc. London. Bot. Vol. 52:159-197. 1939.

Bulb spheric-ovoid, tunicate, often conspicuously attenuate upwardly. Leaves falcate-strap-shaped to linear, the 1 to 3 unimpaired younger leaves rounded at apex, the older truncate and always lacking the apex, distichous, biflabellately disposed, mostly spreading or the younger appressed, gradually withering down to the apex of the bulb after a certain period of time, the same leaves growing again the next season from the base and forming new leaves, the same leaves probably persisting through several seasons, the margins mostly scarious, conspicuously erose. Scape lateral, compressed, solid. Umbel 1—many-flowered. Spathe valves 2, persistent, papery. Bracts filiform, mostly broadened toward apex, persistent. Pedicels more or less terete, variable in length, not elongating in fruit, the lower not delexed. Flowers actinomorphic. Perianth tube forming a straight line (not an angle) with the pedicel, narrowly cylindric, mostly obtusely angled, more or less broadened in the throat. Perianth lobes equal or the inner a little shorter and narrower, mostly much shorter than the tube or more rarely longer, spreading, recurved or spirally revolute at apex, narrowly oblanceolate, obtusish, the outer strongly hooded, obtusely keeled, red or white, the color varying in age. Stamens slightly or strongly exserted from the perianth tube, affixed in the throat or near the mouth of the tube; filaments filiform, straight or more or less curved upwardly, subequal or the inner longer, regularly disposed, erect or more or less divergent, never declined, white to red; anthers linear-oblong, straight or curved, dorsifixed, attached at the middle or well below the middle of the connective, more or less versatile, yellow or pale; pollen pale yellow. Ovary obtusely angled; ovules 4-30 in each cell, biseriately disposed, inserted all over the side of the placentae. Style filiform, included or well exserted, sometimes the length varying with age, straight or at length more or less curved, the same color as the filaments. Stigma entire, minutely 3-sulcate, papillose. Capsule indehiscent, membranaceous, subglobose, finally irregularly ruptured, the pericarp not at all strongly ribbed, finally completely withdrawing from the pedicel. Seeds fleshy, pale green, subglobose or obtusely angled, often germinating in the capsule; embryo straight, endosperm copious.

GENUS STENOMESSON

Stenomesson Morrisonii Vargas, Nat. Hort. Mag. 22:132-135. fig. p. 133. 1943.

Bulb subglobose, produced into a robust neck up to 8 cm. long; leaves oblanceolate, up to 50 cm. long and 22.5 cm. broad, numerous, coetaneous;

peduncle solid, 35 cm. long, 8 mm. broad; flowers 3-11, umbellate, the pedicels thin, pendent, 3.5 cm. long; perigonium greenish white, 3.5-4 cm. long, funnel-shaped, narrow in the lower third, 12 mm. broad above, the cup bifid; stamens a little longer than the perigonium; style filiform, very much exserted.

REGISTRATION OF NEW AMARYLLID CLONES

Description of new clones of hybrid amaryllids for this section should reach the editor by June 1 if at all possible. Information sent after that date may be held over to the next issue if space is not available. This information is published to avoid duplication of names, and to provide a place for authentic recording of *brief* descriptions. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used.

At present there is a limit to the number of descriptions included from any one member. Not more than five brief descriptions of clones under each generic heading will be published free of charge from any one member in any issue of HERBERTIA. Additional descriptions will be published in the advertising section at regular ad rates. The first five descriptions will appear in this section and the excess will be continued in the section entitled, "Buyers Guide."

AGAPANTHUS CLONE

Introduced by Frank J. McCoy, Santa Maria, Calif.

Frank McCoy. Flowers large pure white, 2 or more inches in diameter across face, segments relatively wide, anthers yellow; umbel about 12 inches in diameter, with 200-300 flowers. An outstanding white clone selected from a large number of seedlings raised from seeds secured from Miss Kate Stanford of South Africa.

HYBRID CYRTANTHUS CLONES

Introduced by Mrs. J. Norman Henry, Gladwyne, Penna.

Rosalie. Near Coral Pink (Ridgway); pale pink with cream face and pale pink edge.

Moonlight. Baryta Yellow (Ridgway); creamy waxy yellow.

North Star. Pure white.

Delicious. Light Jasper Red (Ridgway); coral pink, white.

Bunker Hill. Coral Red (Ridgway); coral red, pale face.

HYBRID CRINUM CLONE

Introduced by Cecil Houdyshel, La Verne, Calif.

Edmund Sturtevant (Houdyshel, 1945). For description see article appearing elsewhere in this issue, and also Figure 124.

HYBRID DAYLILY (HEMEROCALLIS) CLONES

Trial Gardens. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.*;

(2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.*, (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.*; (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.*; (5) *Texas Agricultural Experiment Station, Dept. of Horticulture, College Station, Texas*; and (6) *Des Moines Park Board, Des Moines, Iowa*. [Complete addresses are given under *Officers and Committees*, below.]

Introducers should send complete collections of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced by Elmer A. Claar, Wilmette, Ill.

Chinese Lacquer. Height 3½ ft., reddish copper, July-Aug.; name suggested by Mrs. Marjorie Brooks.

Old Copper. Height 3½ ft., henna with red brown eyes fluted segments; very prolific and long blooming; selected and named by Mr. Ralph Schroeder; July-Aug.

Nimble Wit. Height 3 ft., overlapping orange red (fire red); star-shaped; July-Aug.

Little Cherub. Height 2½ ft., monochrome yellow, no green in throat; full clear yellow; flower 3½" across; flower full, segments overlapping; June 10.

Little Imp. Height 2 ft., very small full black flower with orange throat; overlapping segments; multiflora type, 1¼" across; August; named by Miss Shirley Gesme.

Note.—The following named clones were described in Mr. Claar's article in 1942 *HERBERTIA* to which the reader is referred.—*Prima, Twinkle Eye, So Big, Vladimir Horowitz, Cadet, Buddie, and Flamingo.*

Introduced by Ralph W. Wheeler, Winter Park, Florida.

Amherst. A large, somewhat irregular flower in purple and white, segments purple with milk white bands through the center. The 30 inch stems often have proliferations; flower well open; segments frilled which are sometimes twisted and sometimes recurved at the tips.

Ballet Girl. This pert flower is medium in size on 22 inch stems and intermediate in form; color is bright crimson, shading lighter to pink along the edges of both sepals and petals.

Robin Hood. A striking bicolor with brilliant carmine petals and sulfur sepals slightly dusted with carmine, the sulfur of the sepals blending into a vivid green throat. The flower is large, has full, roundly recurved petals which are frilled and creped. The 3 foot stems are multiflora and carry proliferations.

Tarrytown. This is a large, compact, roundly recurved flower with wide segments. The all over color is one of the deep wines, close to Claret of the Standard Color Card (S.2167), possibly a little more towards the purple. Vigorous, free blooming on 3 foot stems.

Victoria. A very large, handsomely colored flower of the finest form. A definite break in *Hemerocallis*, it opens with a flat face, shallow

trumpet and circular effect, in the way of a fine Dutch Amaryllis. The segments are wide, beautifully fashioned and with uniform twists at the tips, enhancing the circular effect of the flower. The main color is Old Rose of the Standard Color Card (S.2183) and the deeper Eye Zone is Bacchus (O.2174), a violet sheen suffusing the entire flower. The stems are 4 feet and gracefully carry these unusually large flowers. A recurrent bloomer in Florida.

Introduced by J. Marion Shull, Chevy Chase, Maryland.

Cherokee Maid (Shull, 1945). For description see article appearing elsewhere in this issue, and also Figure 123.

Introduced by L. Ernest Plouf, Craemore Gardens, Lawrence, Mass.

September Red, 3½ ft. Sept., excellent and deep in red tone; inner segments very broad, deep fulvous-red, decidedly recurved at tips; outer segments slightly toned; bicolor effect from distance; 4" well open flower; wide yellow throat; yellow midrib on inner; no deeper zone; distinct from multiflora-formed flowers.

Subtle Pleasure, pastel shade of soft rich fulvous-ecru; veined deeper; yellow throat olive-cast; inner segments decidedly crinkled yet good form and substance; keeps well late.

Twillo, rose chocolate on tips only; unusually wide flaring lemon throat extending high to tip-coloring, ending in spray-fashion; inner segments very spatulate, overlapping, round and blunt at tips; well and broadly open; not recurved; round outline; fine smooth form; outer segments paler than throat; small flower; distinct pattern.

Odakim, 3½ ft. July-Aug., wide gold throat; maroon blotch bisected on inner segments by midrib; inner segments crinkled and broader than outer; rest of flower brownish orange; large; good form and substance; good grower.

Pasha Boy, 3½ ft. July-Aug., bold 6" flower; rich coloring; wide bright orange throat ending abruptly on outer segments; inner segments deep maroon—deeper at edge of throat with cream midrib; outer much paler; even firm form; well open; evenly recurved; keeps well late.

Introduced by Hamilton P. Traub, and J. S. Cooley.

Santa Lucia. Plant of medium height; very attractive in bud, outside of sepaline-segments before opening Chinese Yellow 606/1 (R.H.S. Chart) in upper part changing to greenish-yellow in lower part, wax-like in appearance, and with a very small green spot at apex; open flowers of medium size, clear Buttercup Yellow 5/2 (R.H.S. Chart), and with a very slight whitish-yellow halo; a recurrent bloomer in lower Salinas Valley.

Introduced by Prof. J. B. S. Norton, Hyattsville, Md.

Colonial. Height 2 ft., flower 4" in diam., petaline-segments Honey Red, spot Hydrangea Red, sepaline-segments Mustard Yellow; late June to mid-July.

Ethel. Height 2 ft., flower 4" in diam., petaline-segments Strontium Yellow to Wax Yellow, with zigzag line of pale vinaceous, sepaline-

segments Strontium Yellow washed with pale vinaceous; late June to mid-July.

Havilah. Height 3 ft., flower 5" in diam., throat wide, greenish; petaline-segments apricot yellow, sepaline-segments chrome orange; segments extra thick; late June to late July.

Introduced by E. J. Kraus, Chicago, Illinois.

Joanna Hutchins. Height 36 inches. Leaves erect, deep green, evergreen. Scape erect, 3 to 4 branched 30 to 40 flowered. Each flower points slightly upward, shed quickly after blooming. Flowers regular, clear pure orange with glistening sheen, diameter six inches, sepals and petals wide, reflexed. Texture smooth, thick, waxy. Odorless. Does not fade or wilt in bright sun. Season July 10 to August 20. Vigorous; rapid propagation. Seedling of J. S. Gayner X Midas selected 1938.

HYBRID AMARYLLIS CLONES

Introduced by Garnald D. Zeiner, Lost Springs, Kansas.

Summer Rose. Eight-inch flower, rose with white stripe; fine form, wide segments.

Giant Orange. Medium size, orange with white stripe, fine form.

Big Chief. Seven-inch flower, solid red.

Deceit. Eight-inch flower, peculiar shade of rose with white stripe when flower first opens, but after a few days the color changes to scarlet.

Triple Trest. Six-inch flower, tri-color; outer edge of segments scarlet, next to outer edge the color is rose and with a white stripe in center.

RICKETT'S "THE CLASSIFICATION OF INFLORESCENCES"¹

HAMILTON P. TRAUB, *California*

In the last two issues of HERBERTIA (9(1942): 53.1943; 10(1943): 134.1944) the writer pointed out that the subject of the origin of the inflorescence in the Amaryllids was a promising field for research, and it is gratifying to have before us now a review of previous work in the whole field of the classification of inflorescences by an eminent authority at the New York Botanical Garden, Dr. H. W. Rickett, who emphasizes the need for much basic research in this field. The review is in two parts—an historical account, and a summary of present day theories including Dr. Rickett's stimulating views.

Dr. Rickett points out that legislation in this field—*attempts to compel the use of definitions of inflorescences*—would not be in the scientific tradition, and adopts as his guide the sound principle, "A rational terminology mirrors that upon which it is based—an understanding of the things concerned."

¹ H. W. Rickett. The Classification of Inflorescences. Botanical Review 10:187-231. 1944. (Address: Botanical Review, Fordham P. O., New York City.)

In this very brief review no attempt will be made to touch on the historical part of Dr. Rickett's article, but the statements made will be confined to that portion concerning the contemporary theories of the inflorescence.

Dr. Rickett states that "we have a right to expect a statement of the fundamental nature of the inflorescence which should underlie any classification" and that the most satisfactory theory, that of Pilger, "begins with a large number of branches which remain simple but are condensed into a system by the disappearance of intervening leaves and shortening of internodes." The primitive inflorescence may have been a much branched system, but it may also be that the compound dichasium was derived from the basic unit the dichasium. Thus the fundamental unit of the inflorescence is indicated as the dichasium, "a cluster formed by the apparent dichotomy beneath a terminal flower." In its simplest form the dichasium consists of three flowers. The compound dichasium could be obtained by repetition of branching. The "clusters originally representing the primitive type have been combined and aggregated in a variety of ways with reduction and loss of intervening foliage, to form what Goebel has termed a synflorescence." The evolutionary steps are (a) "limitation of the individual dichasia to a few flowers, often two or one; (b) grouping of branches bearing leaves and terminated by dichasia on a common axis, a grouping which involves a shortening of the branches and of the internodes between them; and (c) reduction of the leaves and bracts."

As applied to the Amaryllidaceae, the monochasial systems as in *Hemerocallis* and *Allium*, "are easily derivable from a dichasium and, in fact, often begin in one."

In the conclusion, Dr. Rickett discusses the definitions of the various kinds of inflorescences, which are defined as flower-bearing branches or systems of branches. He claims that the definitions of the raceme, spike, corymb, umbel and capitule "are usually clear enough in current treatments." Definitions of the cincinnus or bostryx, cyme, thryse and panicle are given.

What is evidently needed is a complete text in English covering the subject on the order of Goebel's *Blütenbildung und Sprossgestaltung*.² An American edition of this work revised and brought up-to-date would serve the immediate need. It may be that Dr. Frans Verdoorn will come to the rescue with a *Chronica Botanica* edition of Goebel's work in the English Language.

² [Supplement 2 to *Organographie der Pflanzen*, ed. 3] i-vii, 1-242, figs. 1-219. 1931.

THE SYNFLORESCENCE OF AMARYLLIS HYBRIDS

A. B. STOUT

The New York Botanical Garden

An examination of a considerable number of horticultural Amaryllis hybrids grown at The New York Botanical Garden revealed that the highest number of flowers on any scape was four. Two of these were primary flowers of the main axis of the scape and for them the disposition and sequence of development were undoubtedly those of a raceme. But of the two secondary flowers one was lateral to each of the primary flowers in a cymose relation. Thus there are two distinct branching systems in such a synflorescence. The primary inflorescence of two flowers is a monopodial determinate raceme. But each of its flowers and its own lateral form a sympodial helicoid cyme or bostryx. The entire group of flower branches is not only compound but heterogeneous in regard to the branching. The external features of these conditions are fully evident in a typical but relatively simple four-flowered synflorescence, a term applied by Goebel (2), such as that shown in Plate 268. In it, and in the diagram of it that is shown in 1 of Plate 269, the bracts, bracteoles, and flowers or pedicels are numbered in respect to their relative positions and the flowers are also numbered in sequence of anthesis. A description of this synflorescence follows.

There are two primary flowers (nos. 1 and 2) and for each there is a large bract that arises from the main axis. One of these flowers is the terminal of the main axis of the scape; the other is terminal for a lateral on this axis. On flower (1) matures first and it is larger than the other (2). Its bracteole is larger than that of the other flower (compare b1 with b2).

In various monocots which have synflorescences less compacted than those of Amaryllis hybrids the positions of the bracts indicate beyond any doubt that the primary branching is monopodial, determinate and racemose. When there are only two bracts one is entirely below the other and the flower in its axil is the first to mature (see diagram 6 in Plate 269). When there are more than two primary bracts the racemose development is often evident both in compacted synflorescences as in *Clivia* (5 in Plate 269) and in loosely branched compound heterogeneous inflorescences as in most species of *Hemerocallis* (4). But in Amaryllis hybrids the two primary bracts are much modified in growth, in position, and in symmetry which is associated with the development of the laterals to the primary flowers.

In the four-flowered synflorescence here illustrated (Plate 268 and no. 1 in Plate 269) the flower 1-1 is lateral on the axis of the primary flower 1. The internode constituting the peduncle of flower 1 is the section between bract B1 and the bracteole b1, and that of the flower 1-1 is between bracteole b1 and b1-1. These sections of the false axis of the bostryx are much compressed and interposed and each bracteole on this axis is spaced at 90° from the bract or bracteole below in an ascending

spiral that is anti-clockwise as indicated in the diagram. This two-flowered unit is a helicoid cyme or bostryx. The two sections of its axis are compressed into thin plates, but the branching is definitely sympodial. The same structural relations exist for the flowers 2 and 2-1 and for their bracteoles, peduncles and pedicels which comprise another two-flowered bostryx.

The compression in vertical growth of the internode between bracts B1 and B2 and of the internodes representing the peduncles of the four flowers and their expansion in diameter result in an aggregate of nodes and internodes that may be called a *synnode*. Each enlarged bract (B1 and B2) encompasses a flower and its auxillary bostryx. Each is keeled in the line of the greatest diameter of the synnode and each has a wide lobe and a narrow one. The nodes at their origin in the stem are almost at the same level and the two bracts fully encircle the scape and the synnode. Their margins expand laterally and the adjacent margins of the two overlap from the base to the apex of an unopened spathe. The excentric growth in the base of each bostryx is such that the narrow lobe of a bract is always on the side of the lateral in the bostryx and the wide lobe of the other bract is interposed between it and its bracteole. Thus the bract that is outside in the overlap on one side of the spathe is the bract that is inside on the opposite side (see diagrams 1 to 4 in Plate 269). It would be of some interest and perhaps of significance to determine the extent of this modification in the synflorescences of the Amarylladaceae and their relatives.

In the *Amaryllis* hybrids observed by the writer, three-flowered scapes bear one solitary primary flower. In two-flowered inflorescences both flowers are primary but a second bracteole often represents the position of the aborted false axis of the bostryx. The pedicels of the flowers arise at nearly the same level in the synnode and they are elongated. Though they differ in length and size, as do the flowers, according to sequence in development, the entire compound heterogeneous inflorescence simulates an umbel, and it is so designated in most taxonomic literature of *Amaryllis*.

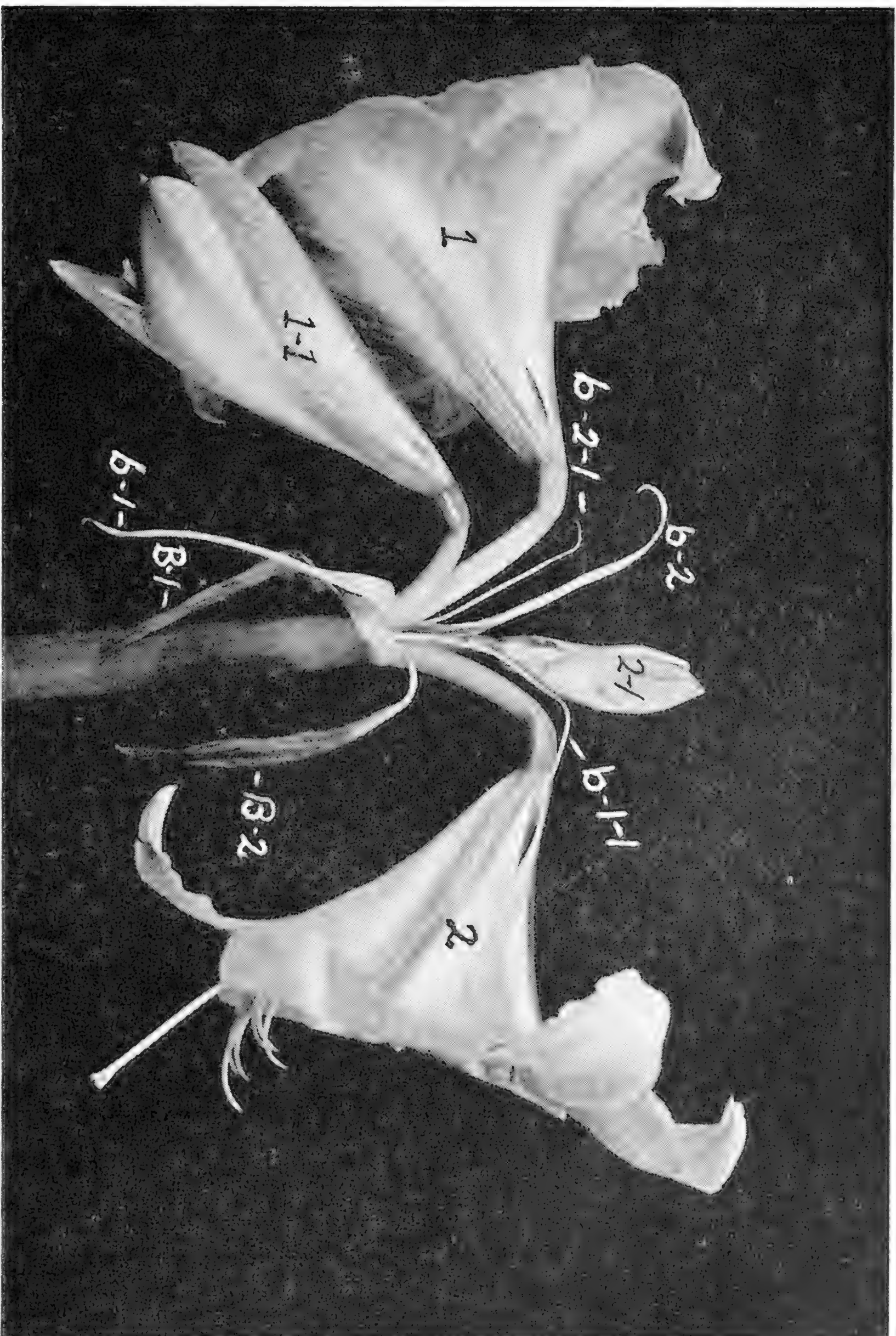
It may be reported that an examination of the 8- to 17-flowered scapes of "*Clivia nobilis*" grown at The New York Botanical Garden in 1944 revealed that there were as many as four different helicoid cymes in a synflorescence and that the arrangement of these units was racemose. The stem of a scape at the level of the bracts was enlarged excentrically to a greater degree than in the *Amaryllis* hybrids, in response to the increase in the number of collateral primary and secondary branches. The number of flowers in a bostryx was as many as four and all of their peduncles were much compressed. A diagram of one of the synflorescences observed in *Clivia nobilis* is shown in 5 of Plate 269. There were four bracts and four bostryxes. In each of the lower two (nos. 1 and 2) the position of the bracts, bracteoles, and pedicels was quite regular. But in each of the third and fourth bostryxes the bract did not encompass its primary flower which stood well toward the center in the synnode of the entire synflorescence while its bract was more toward the

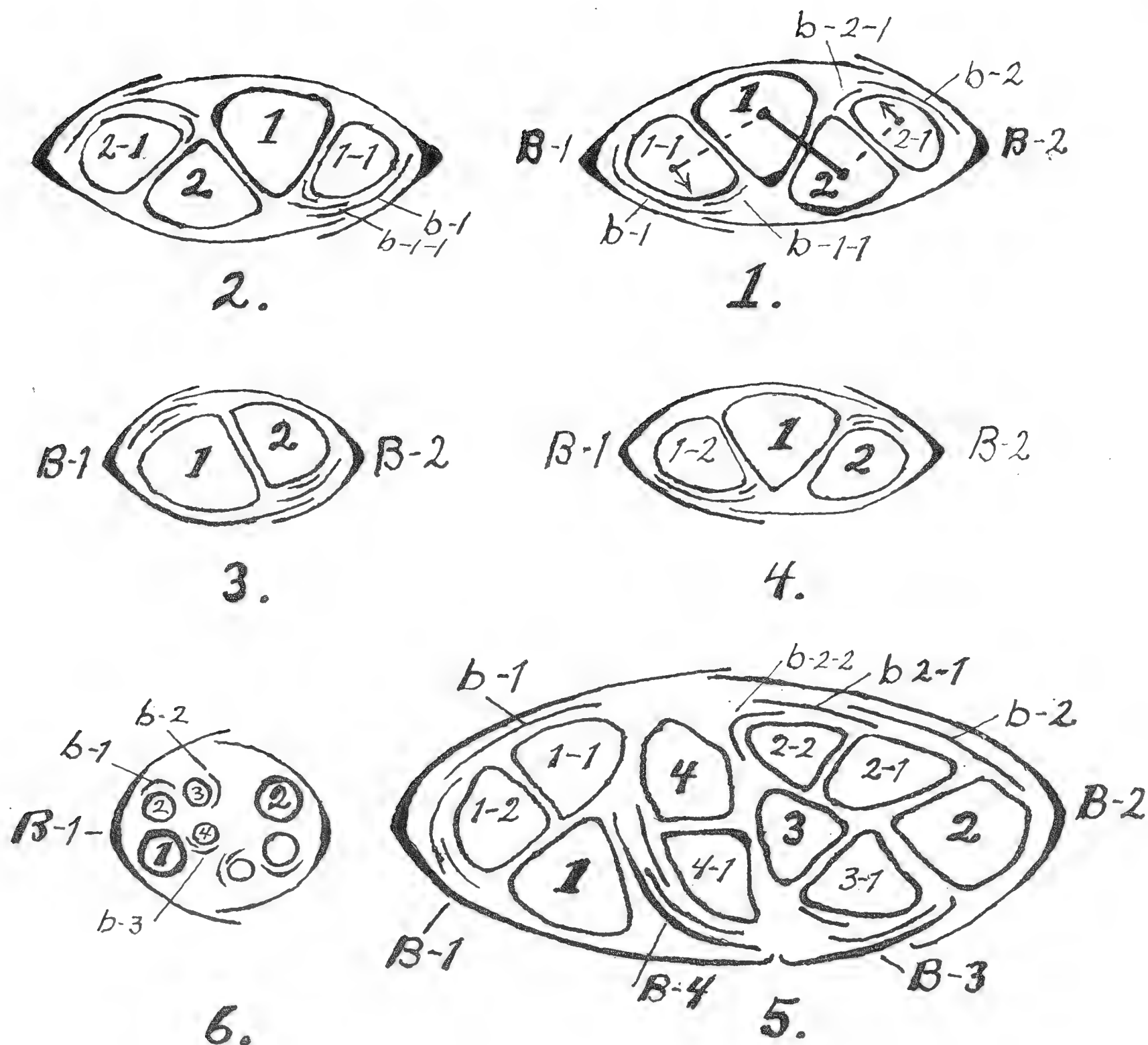
outer border. For each bostryx there was a bract and for the base of each pedicel there was a bracteole. The four bracts of the primary raceme and each series of bracteoles all had a spiral spacing of approximately 90° .

According to Goebel (1) the true umbel, either simple or compound, is exclusively racemose, but there are cymose umbels with dichasial branching which superficially resemble true umbels. More recently Goebel (2) has emphasized that especially in monocots inflorescences which appear to be umbels may be composed of several different cymose inflorescences. For an example of this he illustrates an inflorescence of *Allium Suwarovii* and refers to the studies made by Weber (6). This investigator observed that there is little difference in the time of the maturity of the primary flowers, that within each unit inflorescence there is repeated cymose branching, and that the number and relative positions of the many branches are not always evident. Goebel recognizes that in the many-flowered and much-condensed synflorescences which surmount greatly thickened scapes (as in *Allium*, *Clivia*, etc.) the developments involve interpolations and displacements of stem elements and the elimination of bracteoles to the degree that the stem units below the pedicels are not distinct from one another. It may be added that these developments also obscure the disposition of the several units of a compound inflorescence which is heterogeneous in respect to branching.

The character of the inflorescence, and especially the judgment as to whether it is a raceme or an umbel, has been the basis of rather important distinctions in evaluating the status and relationships of genera and of still larger groups of plants. In his evaluation of the Liliaceae and the Amaryllidaceae, Hutchinson (3) considers that the character of the inflorescence is more important than is the position of the ovary. In his revision of the Amaryllidaceae several new families were made by extractions largely on the view that of the legitimate members of this family the "most distinct and constant feature is the umbellate scapose inflorescence."

Frequently in discussions of taxonomy and phylogeny the reference to a racemose inflorescence actually refers to secondary branches that are helicoid cymes. Also many references to an umbel refer to synflorescences in which the basic or primary branching is racemose and the secondary branching is cymose. Usually an inflorescence of *Hemerocallis* is termed "racemose." But the extended secondary branches are helicoid cymes; the arrangement of the primary flowers of these bostryxes is, however, racemose. The sequence of the heterogeneous branching, primary and secondary, is the same as that in the Amaryllis hybrids. In the genus *Hemerocallis* (4) there is much diversity and specificity in such features as (a) degree of branching, (b) fusion of stem elements, (c) dichotomy, and (d) displacement of bracts and bracteoles. In one species (*H. nana*) there are only primary flowers in racemose development, and often scapes bear a single terminal flower whose axis has only one bracteole and one bract. For the species that have much-branched





Diagrams 1 to 4 inclusive are of inflorescences of *Amaryllis* hybrids. No. 1 is for the inflorescence shown in figure 1, and the numbering of the flowers, bracts and bracteoles is the same in both. In diagrams 1 and 4 the spiral disposition is counter clockwise; in 2 and 3 it is clockwise. In diagram 3 the two flowers are primary ones; in 4 there is a lateral (1-2) to only one (1) of the primaries.

Diagram 5 is of a compound heterogeneous synflorescence of *Clivia nobilis* in which there were four primary flowers (1 to 4) and bracts (B1 to B4). Each of these flowers was the first flower of a bostryx and each flower had a bracteole.

Diagram 6 is for an inflorescence of *Hemerocallis Middendorffii* which had only two primary flowers (1 and 2); the two bracts overlapped and one was entirely below the other. On the false axis above flower no. 1 there were three flowers; above flower no. 2 there were two flowers as indicated. Usually in *Hemerocallis* there is at least one small bracteole of the aborted end of the false axis and occasionally this is present in *Amaryllis* hybrids.

terminal inflorescences there are several secondary units each of which is an extended bostryx. In one species the two branching systems (*H. Midendorffii*) are condensed into a synflorescence.

A recent revision of the genus *Amaryllis* (5) includes species formerly called *Hippeastrum*. In the tentative key to the subgenera and species it is indicated that the number of flowers "per umbel" is different for certain species. For three species the number is *one*; for five species the number is 1-2; for two species the number is 2-6; and for seven species the number is 3-10. These differences suggest that there may be specificity either (a) in reduction to a single primary system of branching that is confined to a main axis or (b) in modifications which retain both the racemose and the helicoid cymose systems seen in the *Amaryllis* hybrids in horticultural culture. The ten-flowered inflorescences may involve either (a) increase in the primary units of the raceme or (b) increase in the number of flowers per bostryx or (c) both of these conditions.

At any rate the term umbel is scarcely adequate for complete descriptions and critical comparisons. It needs further qualification in respect to what the branching is, especially when there is heterogeneous branching that includes both the monopodial raceme and the sympodial bostryx. The umbel is the expression of a habit of vegetative growth characterized by a differential repression of elongation in a series of internodes. In the *Amaryllis* hybrids this condition is localized in the apical internode of the scape and in the peduncles of the several flowers, secondary as well as primary, and racemose as well as cymose in development. To this condition the elongation of the pedicels which are next above is in sharp contrast as is also the greatly elongated and expanded internode which forms the scape below. These highly specialized features of vegetative growth are so fundamental that they may affect, and transform, and combine both a monopodial racemose branching and a sympodial cymose branching.

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[AMARYLLIDS; SAN FRANCISCO SCHOOLS, continued from page 44.]

We finally agreed that during normal times after the war, we could expect a number of students whose abilities would give promise of a scientific career. Such students could assist with breeding and cultural experiments and thus secure an introduction to plant science. If this work should lead to something of value in the field of plant breeding, we would accomplish two worth while ends.

Accordingly we are making as broad a collection as possible at this time and then we can begin to work with them as soon as we have a definite program of work. Our school is trying to obtain the back numbers of HERBERTIA and Mr. Silva has become a member of the Society so that we can keep up with current amaryllids activities.

That is all of the story that has any interest and I am sorry it is not more complete. I will take grateful advantage of your suggestion about writing to Mr. Huey. I already have some information regarding school gardens in other parts of the country but the more I have the fewer mistakes will be made.

With the best of regards, I remain,

yours sincerely,

Harry E. Nelson,
Division of Horticulture

3. CYTOLOGY, GENETICS AND BREEDING

PROBLEMS AND PROGRESS IN ONION BREEDING

H. A. JONES, *principal olericulturist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.*

According to written records, the onion has always been one of the most popular of vegetables. Its culture and use date back to a very remote antiquity. According to Sturtevant, as reported by Hedrick (7), it is:

One of the things for which the Israelites longed in the wilderness and complained about to Moses. * * * Onions were prohibited to the Egyptian priests, who abstained from most kinds of pulse, but they were not excluded from the altars of the gods. * * * They were introduced at private as well as public festivals and brought to the table. The onions of Egypt were mild and of an excellent flavor and were eaten raw as well as cooked by persons of all classes.

Vavilov (30) names the middle-Asiatic center, comprising northwestern India, all of Afghanistan, the Soviet Republics of Tajik and Uzbek, and western Tien Shan, as the primary place of origin of the commonly cultivated onion, *Allium cepa* L. As secondary centers of origin of this species he lists (1) the Near East, which includes inner Asia Minor, the whole of Transcaucasia, Persia (Iran), and the alpine Turkmen Republic, and (2) the Mediterranean region. For the Japanese onion, *A. fistulosum*, which is cultivated extensively in the Orient, Vavilov gives the primary place of origin as the Chinese center, which comprises alpine central and western China and the adjacent lowlands.

From these centers of origin the onion has spread to all countries where the crop can be grown at some season of the year. Just when the cultivated onion was first introduced into North America is not known, but at present it is cultivated everywhere in this country, in home gardens, in market gardens, and as a truck crop. Immature onions are found on the markets everywhere at some season of the year and onion bulbs are found on most markets throughout the year. As a rule, onions are used by most families in comparatively small quantities, but fairly constantly, for seasoning, in salads, and as a main dish prepared in a variety of ways. The onion is especially suitable for dehydration. Onion salt is used extensively for seasoning catsup, chili sauce, soups, and sausage. Though the quantity of onions consumed per capita is not large, the total amount used gives this crop a commercially important place among the vegetables. The average onion acreage for the United States during the 10-year period 1931 to 1940 was about 130,000 acres with a production of about 15 million 100-pound sacks, giving a yearly return to the producers of approximately 12 million dollars.

Growers in every onion district meet with production difficulties. The crop is attacked by a number of very destructive insects and diseases, and these exact an enormous toll every year. For most of these problems satisfactory chemical control methods have not been developed, and the breeding of resistant varieties seems to be the only solution. Unfavorable weather conditions cause losses from sunburn, blast, and freezing. The use of inferior strains or varieties poorly adapted to the region may cause losses from bolting, doubling, or scallion formation.

Adaptation

The onion is very sensitive to its environment, therefore selections, especially for yield and time-of-maturity, should be made in the region where the new variety is to be grown. This is especially important in developing onion varieties for the far South. A variety that is early maturing at Bakersfield, Calif., or Charleston, S. C., may be late maturing in the lower Rio Grande Valley of Texas. At Bakersfield, Calif., the variety San Joaquin matures at about the same time as Crystal Wax, but in the lower Rio Grande Valley it matures too late to make a good bulb. As shown by Magruder and Allard (23) and Thompson and Smith (28), the adaptation of varieties to certain regions is determined largely by the conditions which affect bulbing, chiefly temperature and length-of-day. The minimum length-of-day necessary to cause bulbing varies with the different varieties but is affected by temperature. At favorable lengths-of-day, temperatures below 60° F. may inhibit bulb formation, whereas temperatures above 70° F. accelerate it. Any increase in temperature or length-of-day above the minimum will hasten maturity. In the South varieties such as Crystal Wax, Yellow Bermuda, Early Grano, and Creole are grown as a winter crop. During the short days of winter when the mean temperatures are fairly low these varieties make a large foliage development and bulbing does not occur until early spring when the days become longer and the weather warmer. During the long winter growing season a large plant is formed, and this usually insures the development of a large bulb in the spring. In the North it is almost impossible to secure good yields of these extra-early varieties by sowing seed directly in the fields. Even when thus seeded as early as possible the length-of-day necessary for bulbing of these early varieties has already passed the minimum. Also, before the plants are many weeks old the minimum temperature necessary for bulbing is reached, and the bulbing begins even though the plants are small, consequently only a few leaves and a small bulb are formed. Besides temperature and length-of-day, different regions vary in light intensity, relative humidity, rainfall, and other environmental factors, and all these exert a modifying effect on the development of certain characters. Thus a variety may do well in one district and be worthless in another, and a selection made in one part of the country may have little value elsewhere. For this reason selections for yield, time-of-maturity, and to a certain extent resistance to various diseases should be made in the region for which the new varieties are being developed.

The Use of Greenhouse Facilities

Though it is desirable to make bulb selections in the important onion regions the selfing and crossing necessary in a breeding program can be done where most convenient. In the national onion-breeding program much of the crossing and selfing work is done in the greenhouses at the Plant Industry Station, Beltsville, Md. As a rule, crossing and selfing can usually be conducted more satisfactorily in a greenhouse than in the open, especially under humid conditions, as the greenhouse environment is almost always satisfactory for pollination.

The chief difficulty in the greenhouse has always been the control of Botrytis rot. In the growing plant this rot starts on the outer scales of the sheath region and gradually works toward the center of the plant. Later on, the seed stems are attacked and may be completely girdled. The use of fungicides has never given satisfactory control. The best control has been secured by providing good aeration and keeping the foliage dry. When bulbs or transplanted seedlings are planted in the greenhouse bench they should be set on raised beds, and after the roots have become established water should be applied only to the furrows between the rows. The soil adjacent to the plant should be kept dry. When plants are grown in pots they are watered from below by use of saucers supplying water to the roots but keeping moisture from the surface soil. The seedstalks are as susceptible to Botrytis rot as the foliage. In the spring when the seed stalks are well developed, about the time the buds break the surrounding bracts, the leaves are stripped away until the seed stem is bare to its base. This may appear to be rather severe treatment, but it keeps the seed stalk dry and thus prevents infection; the flowers open normally; and heavy sets of seed are obtained.

The onion thrips (*Thrips tabaci* Lind) are also very destructive to the crop in the greenhouse, damaging the foliage and later the flower heads as they develop. Frequent applications of liquid sprays, such as tartar emetic and brown sugar, are required to keep the infestation within reasonable control. These control measures of necessity wet the plant and encourage the development of Botrytis rot. Fumigation with heavy dosages of calcium cyanide kills large numbers of exposed adults, but few or none of the larvae in the plant interstices. Recent tests by Floyd F. Smith and L. D. Goodhue, of the Bureau of Entomology and Plant Quarantine, and the author with aerosols containing DDT have indicated that this method of control is much more effective than any previously used and may go far toward solving the problem when DDT is commercially available. The results of this work have been published by Smith and Goodhue (27A) in the *Journal of Economic Entomology*.

The Use of Flies as Pollinators

At practically all places where onion breeding is under way flies are being grown or trapped to do the necessary pollinating. At Beltsville, Md., both house flies and blow flies are raised under controlled con-

ditions. Flies do a better job of pollinating under cages than any other insects that have been tested. House flies are used in the greenhouse in early spring before blow flies can be trapped or raised out-of-doors. The method of raising house flies is that recommended by the National Association of Insecticide and Disinfectant Manufacturers, Inc., for growing test flies for evaluating liquid household insecticides. The rearing room is held at 80° to 85° F. and between 40 to 70 percent relative humidity. For growing the larvae a special culture medium is made of 400 grams of soft wheat bran (coarse) and 200 grams alfalfa meal. These are mixed together thoroughly. To this is then added a mixture of 16 cubic centimeters of malt extract, 10 grams of compressed yeast, and 900 to 1,000 cubic centimeters of water. This is then stirred into the bran-alfalfa to obtain a loose mixture and placed in the culture jars until they are about three-fourths full. The proportion of liquid to dry ingredients may be varied slightly to prevent mold growth.

Flies 4 and 5 days old oviposit readily on rolls of cotton impregnated with milk placed in petri dishes or other containers. Egg masses are readily removed from the cotton, and about 2,000 eggs are transferred from the moist cotton to each culture jar. This number of eggs will produce 1,500 to 1,800 flies. The number of eggs can be estimated volumetrically by gently shaking in water and allowing them to settle in a graduated tube. When settled, one-tenth cubic centimeter contains about 500 eggs. By the eighth or ninth day after preparation the larvae have usually migrated to the top inch of media and pupated. The pupae are separated from the medium by lifting off the top half-inch of the medium, loosening the exposed pupae, and then pouring the pupae with adhering particles of medium on a cafeteria tray. The mixture is placed in a fan blast until dry enough for the pupae and medium to separate readily in a stream of air. Funnels or other equipment may be used to help in the separation. The pupae must be handled gently to avoid injury.

If the flies are to be used for pollination just as soon as they emerge the pupae can be held in cotton-stoppered bottles and then placed into the pollination cages as soon as the adults begin to emerge. If the flies are to be held for a few days they should be placed in screen cages. Each cage is supplied with a dish containing a 1:1 milk-water mixture. A small ball of cotton will provide a good feeding area. Forty percent formaldehyde solution added to the diluted milk at the rate of 1:1,500 delays souring of milk for several hours. Satisfactory food must be available to the flies at all times.

During the first warm days of spring blow flies can be trapped in large numbers in the open. Fish heads and chicken entrails have made very attractive bait. Trapped flies can no longer be used when there is danger of contamination from onions flowering in the home garden. Blow flies are then grown under controlled conditions, as described by Jones and Emsweller (13). Lungs of beef, upon which the adult blow flies lay their eggs, are exposed in the open. The lungs are placed under a roof to provide protection from high temperature and rain which might kill many of the larvae. In most places it is necessary to screen

the meat to protect it from predatory meat-eating birds and animals. Within a few days the eggs hatch and the maggots begin to feed. When mature they begin to wander about to find a place to pupate. As they leave the meat they are trapped in buckets partly filled with screened sand. Once a day the pail is removed and replaced by another so that each container will have larvae of approximately the same age. The larvae soon burrow into the sand to pupate, and later the pupae are separated from the sand by screening. The pupae are held at room temperature in bottles or paper bags until the flies start to emerge. The pupae are then placed in the cloth pollination cages or in small screen cages. The latter are about 6 inches by 6 inches and have a cone-shaped top, at the apex of which is a small opening closed by a cork. As the flies emerge they gradually move up into the cone. When adding flies to the pollination cages the cone is inserted into the lower end of the cloth cage, the cork is removed, and as many flies as needed are allowed to escape (Plate 270). The number of flies admitted depends upon the number of flowers to be pollinated. The flies in the pollination cages need to be replenished every 4 or 5 days, especially during hot weather.

Inbreeding

In the onion, selfing or inbreeding, accomplished when a plant is self-pollinated, is not an end in itself but merely one of the tools used in the breeding program. Inbreeding in the onion is almost always accompanied by a loss of vigor for a number of generations. However, it permits many undesirable characters that have been carried along in the germ plasm to express themselves so that the lines possessing them can be rogued out. The main purpose of inbreeding is to develop lines that will breed true for certain characters. Unquestionably the production of hybrid-seed is going to play an increasingly important role in onion production. As inbred lines are used almost exclusively for the production of hybrid seed, the need for developing selfed lines that possess certain outstanding characteristics will become increasingly important.

Selfing is accomplished in the onion by enclosing the flower heads of a plant to prevent contamination with foreign pollen. Formerly single inflorescences were covered with 1-pound manila paper bags. Then once or twice each day, when the pollen was dry, the bags were tapped rather vigorously to help circulate the pollen within. As a rule, the amount of seed obtained by this method is rather small. Much larger quantities can be secured by enclosing one or more flower heads under a cloth cage and introducing flies to do the pollinating.

Jones and Davis (12) reported on the effects of inbreeding for six varieties of onions that had been inbred from one to six generations. Some years certain inbred lines yielded as much as the commercial parent, but, in general, the weight became less as inbreeding was continued. Usually the loss in weight was greatest in the first generation of inbreeding. Many inbred lines of onions were isolated that were superior to the

commercial parent in many characters except for vigor. Certain inbred lines were less inclined to bolt, had better keeping quality, and were more uniform in size, shape, color, and time of maturity.

The results indicate that the probability of developing good high-yielding commercial lines by inbreeding are remote, but superior lines can be isolated for hybridization purposes.

It is possible, nevertheless, occasionally to isolate inbred lines that are sufficiently outstanding to make a place for themselves in commercial competition. Red 21 is such a variety. This variety, released by the California Agricultural Experiment Station in 1935, is an inbred line of California Early Red. In 1924 a bulb selected from a lot of California Early Red, grown at Davis, Calif., was given the pedigree number 21-22. In 1925 this plant was selfed and in 1926 the progeny was grown. A bulb selected from this progeny lot, pedigree number 21-22-1, was grown and selfed in 1927, and its progeny was grown in 1928. The best bulbs were massed, and a supply of seed—Red 21—was secured for trial. Repeatedly in several districts of California, Red 21 proved much superior to commercial stocks of California Early Red. It matured somewhat earlier, was more uniform in size, shape, color, and time-of-maturity, and kept better in storage than the older strains of this variety. Thus it is sometimes possible to develop commercially acceptable varieties by inbreeding. The yielding ability of this strain has not been compared with that of the older strains of California Early Red because seed of the latter has not been available for some time; no doubt some vigor was lost in the two generations of inbreeding. Though it is possible occasionally to obtain inbred lines with sufficient vigor to make good commercial onions, methods of improvement must be adopted that increase rather than decrease yields.

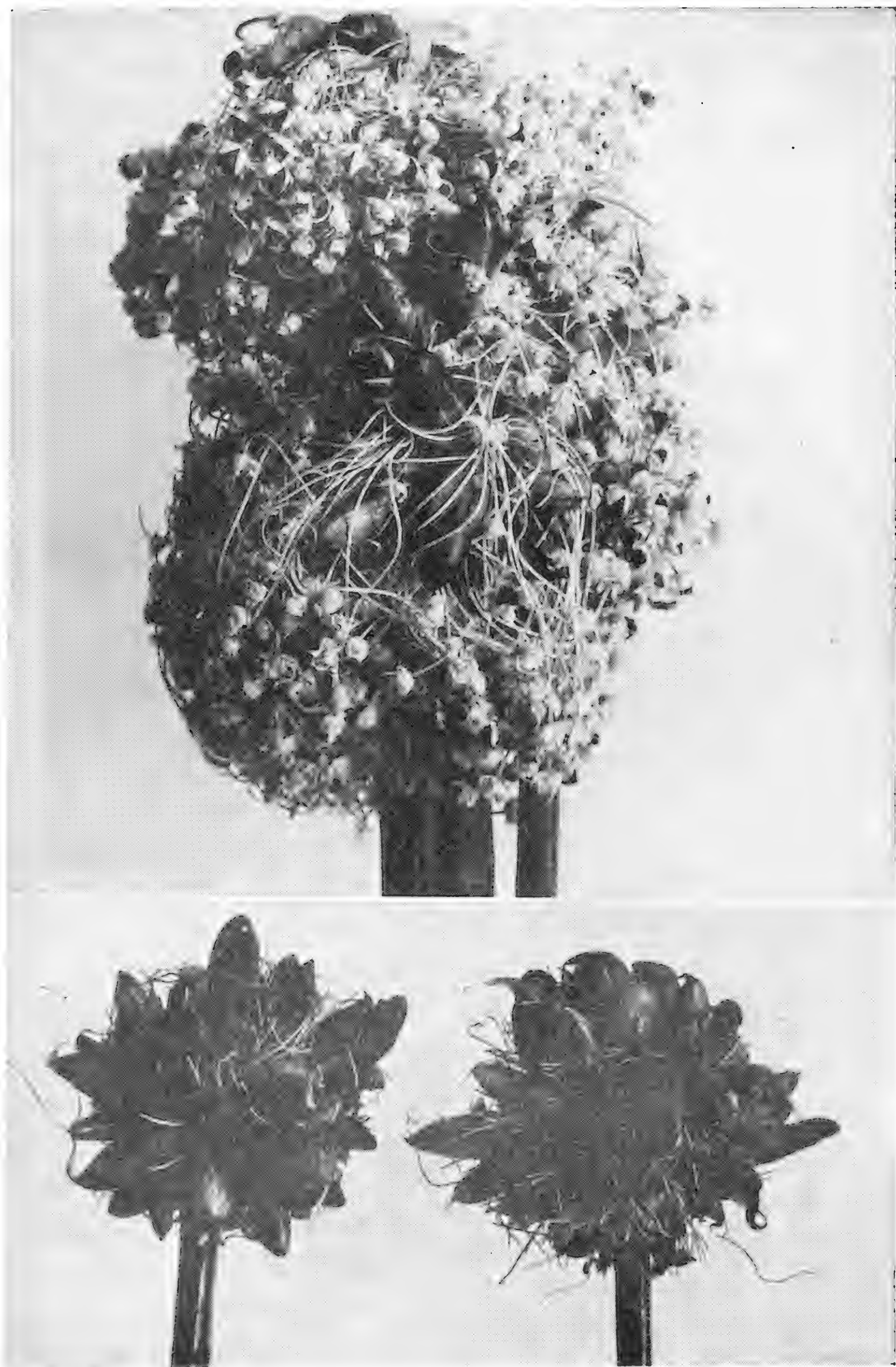
Inbreeding, however, becomes an integral part of a program for the production of hybrid seed. As a rule, most lines are fairly uniform after two generations of inbreeding, but if inbreeding is continued most of the lines become rather weak and difficult to propagate. After about two generations of inbreeding the plants within a line can be massed to prevent further loss of vigor. Certain lines, however, become fairly uniform after five or six generations of inbreeding.

Crossing

When new characters are to be incorporated in a variety, a breeder must resort to crossing. At first only a few flowers in an umbel open daily, but the number increases until full bloom, when 50 or more may open in a single day. During this early period the open flowers are removed several times daily from the umbel of the female parent. When the weather is hot they must be removed often because anthers shed their pollen very soon after the flower opens. When blossoming is at or near its peak open flowers are no longer removed but are emasculated and used for crossing. Umbels must be examined frequently and the anthers



Method of introducing flies into small cloth pollination cages. The cages are made of cheesecloth stretched over wire frames and tied at both ends. These cloth cages are used for both crossing and selfing.



A, Seed head of Italian Red 13-53 before removing seed capsules. Note the excellent set of hybrid seed. Although the strain is male-sterile, hybrid seed is readily produced by crossing with plants having good pollen. **B**, Seed heads of Italian Red 13-53 after removing the capsules, showing the bulbils that are used to propagate this male-sterile line (**Hilgardia** 12: 1939).

removed from the open flowers before pollen is shed. When 50 to 75 flowers have been emasculated the remaining buds of the inflorescence are removed. The emasculated and disbudded umbel is then enclosed under a small cheesecloth cage, as is shown in Plate 270. The inflorescence of the male or pollen parent is cut off and enclosed within the same cage with the base of the stalk standing in a bottle of water. When handled in this manner the flowers continue to open and shed pollen for a week or more. In greenhouses the pollen parents can be grown in pots, and these can be moved freely from place to place, so that the inflorescences need not be cut off. Flies are used as pollinators.

Breeding for Resistance to Thrips

Thrips are present wherever onions are grown. It is estimated that they cause more loss than all other insect pests and diseases combined. Chemical control in the field has thus far been unsatisfactory, and this necessitates a different mode of attack. Jones, Bailey, and Emsweller (9) showed that certain varieties of onions have definite resistance to thrips, White Persian being the most resistant. The resistance of this variety seems to be determined by certain growth characters which help to hold the thrips population to a minimum and perhaps by anatomical and physiological characters which help the plant to withstand injury. The shape of the leaves is probably of importance in restricting the thrips population. In most onion varieties the leaf blades have a flat side; in opposite leaves these sides are face to face, and the young leaves are closely pressed together so that the environment may be more favorable for the larvae and they may have greater protection against insect enemies and adverse weather conditions. In White Persian the leaves are almost circular in cross section, and this protection is thus reduced. The wide angle between the two innermost leaves, especially in the young plant, is another White Persian character that helps restrict the thrips population by further reducing their protection. Another character that may be of some importance is the vertical distance between the leaf blades, each new leaf extending farther beyond the one encircling it than in other known cultivated varieties. If commercial varieties had these leaf characters the thrips population per plant would be reduced to a minimum, and it would be possible to secure more efficient control by spraying and dusting.

Peterson and Haber (24) showed that the nearly mature leaves of White Persian had a thicker epidermis than either Sweet Spanish or Scott County Globe. They suggest that a thick epidermis probably reduces thrips damage by offering greater mechanical resistance to puncturing and by limiting the depth to which the thrips stylets can penetrate the leaf tissue. Migrating adults probably do not remain on such plants because the food supply is not easily available. The thickness of the epidermis on young center leaves of resistant plants may be no greater than on mature leaves of the susceptible plants. Thus a small portion of the total leaf area of a resistant plant may be as vulnerable to attack

as a susceptible plant. However, in these young leaves the cells are enlarging rapidly and soon attain what might be termed protective proportions.

The White Persian and a strain selected from Australian Brown have glossy foliage and glossy seed stalks. In field tests the glossy plants show considerable resistance to injury by thrips, consequently this character is being used in breeding for thrips resistance (9).

The development of thrips-resistant varieties has been a major cooperative project for a number of years between the United States Department of Agriculture and experiment stations in a number of States, and as a result varieties much more resistant than our present commercial varieties will soon be available.

Breeding for Resistance to Various Diseases

Downy mildew. The onion downy mildew (*Peronospora destructor* (Berk.) Casp.) is practically world-wide in distribution. Though sporadic in occurrence it is probably the most destructive disease of onions in the United States. In the North, damage is chiefly to the bulb crop. On the West Coast it is particularly serious on the crop grown for seed. Primarily because of mildew a large part of the onion seed acreage has been shifted from the West Coast to other areas less subject to this disease. No entirely satisfactory control method by the use of fungicides has been developed. Apparently the only satisfactory means of control will be the use of resistant varieties. Jones, Porter, and Leach (15) report that the male-sterile Italian Red 13-53 is the best parent isolated to date for the breeding of mildew-resistant onions. It has a high degree of foliage resistance in field plantings, the amount of injury being negligible. Infection on this selection is usually confined to the tips of the leaves, and growth of the fungus toward the base is exceedingly slow. The seed stalks of Italian Red 13-53, however, are immune, lesions have never been found even during the most severe epidemics. The high resistance of Italian Red 13-53 is being bred into a number of the important commercial varieties, and definite progress is being made. Most of the populations are being tested at Milpitas, Calif., where mildew appears in epidemic form every year.

Pink root. Pink root of onions, caused by the fungus *Phoma terrestris* Hansen, is a major disease in most of the onion-growing districts of the United States. As the organism lives and multiplies in the soil, chemical control is not practicable, and again the use of resistant varieties seems to be the only permanent solution. Early Grano is one of our most susceptible varieties. Felix (5) reported that the Winterhecke and White Welsh varieties of *Allium fistulosum*, as well as different strains of Nebuka, are resistant to pink root. Yellow Bermuda is also fairly resistant. Porter and Jones (25), working in California, found that Sweet Spanish was slightly resistant and that certain selections from this variety were able to produce fair crops on highly infected soil. A highly resistant selection called Spanish 2 was released by the California Agricultural Experiment Station in 1939. This selection and resistant bulbs from various other sources are being used to develop resistant varieties.

Smut. Onion smut (*Urocystis cepulae* Frost) is widely distributed and is of considerable economic importance in the northern onion-growing sections of the United States. Only in the seedling stage is the host susceptible to attack. Onion smut in commercial fields is controlled by applying formaldehyde in the row at the time of seeding. Nevertheless the development of resistant varieties would be of value since their use would eliminate considerable labor and expense. Anderson (1) tested 54 varieties of cultivated onions, and since none of these showed any marked resistance to the disease it appeared probable that all commercial varieties of *Allium cepa* are susceptible. However, in a test of 39 other species of *Allium* 8 did appear to be immune. The description of one of these suggests that it belongs to *A. fistulosum*. Felix (5) also found that the Nebuka type of *A. fistulosum* was highly resistant to smut. Fortunately *A. cepa* and *A. fistulosum* cross fairly readily, and hybrids of these species have been obtained by Emsweller and Jones (4), Levan (17), and Maeda (22). *A. fistulosum* is then a source of smut resistance that may be bred into commercial varieties of onions. Unfortunately, these hybrids have been highly self-sterile. Data presented by Walker, Jones, and Clarke (33) show that the F₁ hybrid is somewhat resistant to smut. Though the F₁ hybrid is highly self-sterile it usually has sufficient good pollen so that a fair set of seed is secured when the hybrid, used as the pollen parent, is crossed again with *A. cepa*. Unfortunately, these backcross plants have given as high a percentage of smutted plants as the *A. cepa* varieties. Since this backcross method has not thus far been very successful other methods are being tried. An amphidiploid resulting from the cross *A. cepa* x *A. fistulosum* has been successfully crossed with the two parents and with their diploid hybrid. Autotetraploids have been successfully crossed with the amphidiploid. Work is being continued with all this material in an attempt to get smut-resistant commercial varieties.

Purple blotch. Purple blotch, caused by the fungus *Alternaria Porri* (Ell.) Cif., is fairly widespread and may cause considerable damage to both the bulb and seed crop. The Italian Red 13-53 selection is somewhat resistant to purple blotch and is being used as a source of resistance in the breeding program. The variety Red Creole is reported by Riollano (27) as showing considerable resistance to this disease and may be one of the chief reasons why this variety has been cultivated so successfully in the humid regions of the South.

Yellow dwarf. Yellow dwarf is a virus disease of the onion that causes a characteristic yellowing, wrinkling, twisting, and drooping of the leaves and dwarfing of the plant. In a field test of 34 varieties Henderson (8) found that Sweet Spanish was the only variety showing marked resistance. Plants of this variety did not contract the disease when inoculated artificially and furthermore did not carry the disease in a masked form. Breeding work is under way to incorporate resistance to yellow dwarf in other varieties.

Smudge. A number of investigators have shown that colored onion bulbs are much more resistant than white to the smudge organism

(*Colletotrichum circinans* (Berk.) Vogl.). The factors responsible for resistance have been given considerable study during recent years chiefly with the hope of developing resistant white varieties.

In a series of studies by Walker and his associates (19, 20, 21, 31, 32, 34, 35) it was shown that a water-soluble substance extracted from pigmented scales was toxic to the smudge organism and that this substance was not found in unpigmented scales. Moreover, these studies showed that certain volatile substances present in onions were toxic, killing ungerminated spores and checking the growth of the mycelium.

The genetic factors responsible for color in the onion were first described by Rieman (26) who demonstrated the occurrence of two kinds of factors for white, one a dominant inhibitor and the other a recessive white factor. Later Clarke, Jones, and Little (3) confirmed these results, but showed that the factors differentiating red and yellow pigments were not allelomorphic with the recessive white factor, as postulated by Rieman. The dominant allele *C* is necessary for color development. A variety of onion homozygous for red has the genotype *ii CC RR*; for yellow, *ii CC rr*; and for recessive white, *ii cc RR*, *ii cc Rr*, or *ii cc rr*. The *I* gene is incompletely dominant in the heterozygous condition, but all bulbs homozygous for *II* are white.

Though it has been known for a long time that colored bulbs are more resistant than white bulbs to the smudge organism, it has not been definitely known whether bulbs heterozygous for the *I* gene are more resistant to smudge than the homozygous whites. In six different crosses Jones and others (16) showed that *Ii* bulbs were more resistant than the *II* bulbs to smudge. These crosses showed also that the heterozygous bulbs *Ii* are approximately intermediate between the two homozygous types in susceptibility.

The fact that heterozygous cream bulbs are approximately intermediate in resistance between the pure white and colored bulbs is important from the standpoint of breeding. It would be highly desirable to obtain varieties of white onions that are resistant to smudge, but if resistance is inevitably associated with the presence of pigment it would be difficult if not impossible to attain such an objective. However, cream bulbs with the genetic constitution *Ii*, though containing some pigment, might be as acceptable as pure white bulbs for certain purposes. The increase in resistance to smudge would probably more than compensate for the sacrifice in color purity. Although it would be impossible to obtain true-breeding strains with the constitution *Ii*, the production of onions with this constitution would be very simple. This could be accomplished through the use of male-sterile strains.

Polyploidy

Jones and Clarke (10) found a natural amphidiploid among their crosses between *Allium cepa* (var. Australian Brown) and *A. fistulosum* (type Nebuka). This amphidiploid shows greater vigor than either parent, as evidenced by increased height, larger stomata, larger flowers, larger pollen grains, heavier seeds, and more rapid growth of seedlings.

The amphidiploid is highly fertile, whereas the diploid hybrid is sterile. Walker, Jones, and Clarke (33) have shown that this amphidiploid is also highly resistant to smut. The amphidiploid behaves as a perennial, although some bulbing does occur. Another natural amphidiploid, from the cross White Portugal x Nebuka, has been obtained at Beltsville, Md. This also shows greatly increased vigor. Because of greatly increased vigor and high resistance to smut an amphidiploid would seem to have

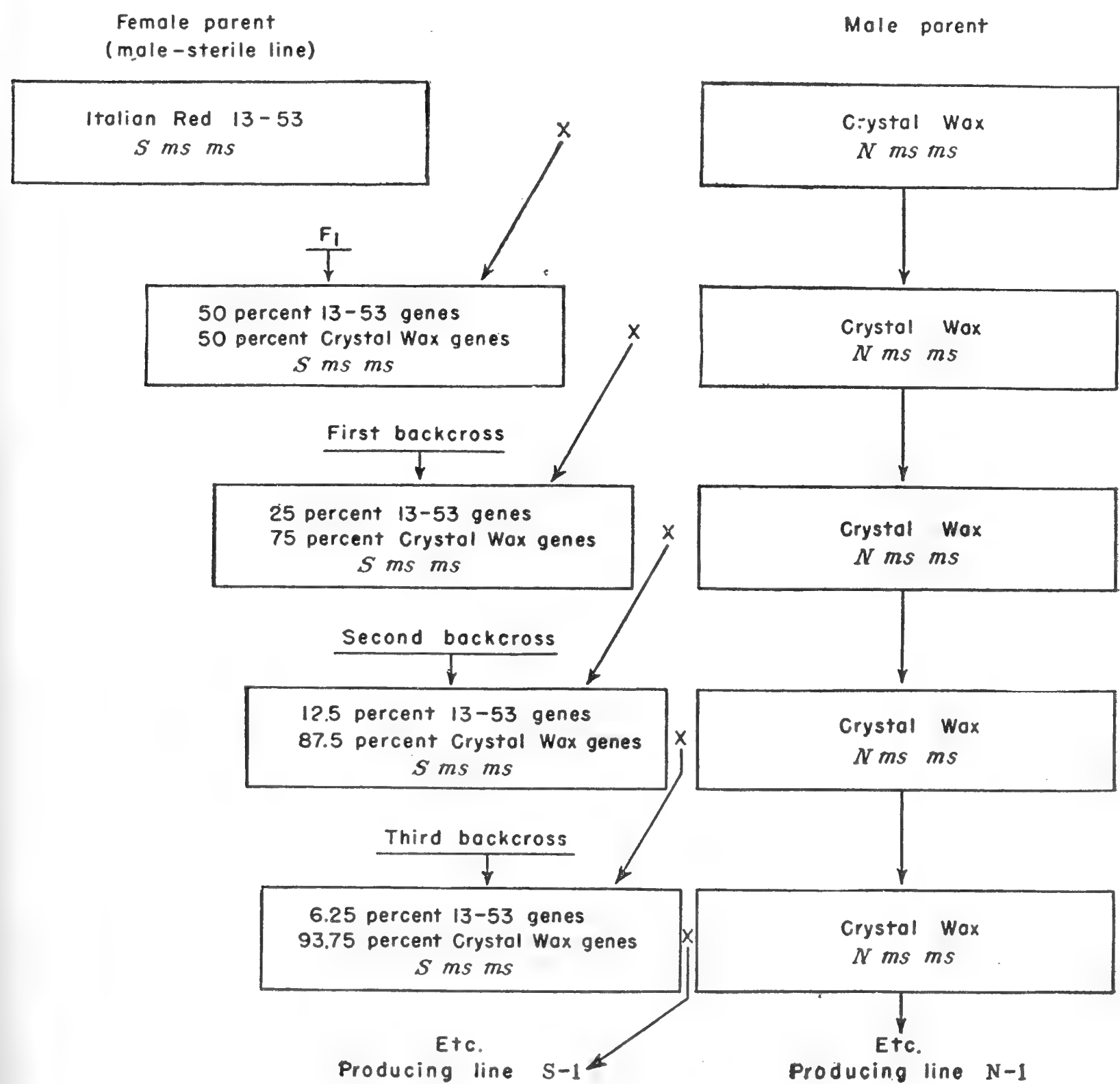


Figure 125. Method of developing male-sterile lines of **Crystal Wax** from **Italian Red 13-53**, showing the rate at which **Crystal Wax** genes are incorporated into the male-sterile line by backcrossing. From USDA Tech. Bull. 874.)

great possibilities as a green bunch onion. Though the above amphidiploids appeared spontaneously, it is not expedient to depend on this method of origin. After seed of the species cross has been secured, doubling can be produced by use of colchicine. Toole and Clarke (29) secured autotetraploids in both *Allium cepa* and *A. fistulosum* by treating germinating seeds with 0.1 and 0.5 percent

aqueous solution of colchicine for 3 hours. Less killing occurred in the 0.1 percent treatment. The killing was also less when the treatment was applied while the roots were less than 0.5 millimeter long. According to these authors the very young seedling stage seems to be the appropriate time for treatment in order to get colchicine into the meristematic tissue of the growing point of the stem. The stem plate is located just above the tip of the radicle and is carried outside the seed coat with the radicle when the latter is only a few millimeters long. At this early stage the meristematic cells of the stem tip are protected only by the cotyledon. As the seedling develops true leaves are differentiated from the stem plate, the growing point becomes more and more deeply embedded, and it becomes increasingly difficult to get the colchicine into contact with the growing tip.

Onion Hybrids

Utilization of hybrid vigor in the onion has created considerable interest and has far-reaching possibilities. The historical and technical details of hybrid onion development are of as great interest to plant breeders as the results have proved to be to laymen. Jones and Davis (12) some years ago obtained very productive hybrids by crossing suitable inbred lines of onions. A cross between Stockton Yellow and Italian Red produced hybrid bulbs more than three times as heavy as either parent. Hybrids of Giant White Italian Tripoli x Red 21, Italian Red x Stockton Yellow Globe, and Italian Red x Italian Red gave highly significant increases in yield when compared with their inbred parents. The results showed great inherent possibilities in the use of hybrid seed for crop production. To get hybrid seed of these varieties it was then necessary to emasculate one of the parents. In the onion the male and female parts are in the same flower, and emasculation is not easily per-

formed as it is in corn where this operation consists merely in removing the tassel. Production of hybrid seed in the onion would not be practicable on a commercial scale if emasculation were necessary. If onion plants are available with impotent pollen these plants are solely female as far as breeding is concerned, and emasculation is not necessary. A plant of this nature was found in the breeding plots at Davis, Calif., in 1924, in the variety Italian Red and was described in some detail by Jones and Emsweller (14). The pedigree designation of this plant was Italian Red 13-53. The plant flowered profusely, failed to set seed when self-pollinated, but set seed in abundance when cross-pollinated (Plate 271-A). Because of self-sterility this selection cannot be carried along as a selfed line, but fortunately it usually produces large quantities of head sets or bulbils (Plate 271-B), so it has been carried along since 1924 as a clonal line. In California the small sets produced in the flower head are planted in early fall, and large bulbs are produced the following summer, maturing in late June or July. These large bulbs are stored for a time, then planted in the field in alternate blocks with a desirable pollen parent. Insects do the pollinating, and all the seed produced on Italian Red 13-53 is hybrid seed.

A large number of varieties and inbred lines have been crossed with Italian Red 13-53, but only one of the hybrids has so far been introduced—a cross between Italian Red 13-53 and Lord Howe Island. This hybrid was introduced cooperatively by the California Agricultural Experiment Station and the United States Department of Agriculture and has been named California Hybrid Red No. 1.

The clonal line Italian Red 13-53 does have certain limitations as a female parent in the production of hybrid seed. It keeps poorly in storage, and this character to a certain degree is exhibited in the hybrids. Its use confines production to red varieties, and the demand for these is

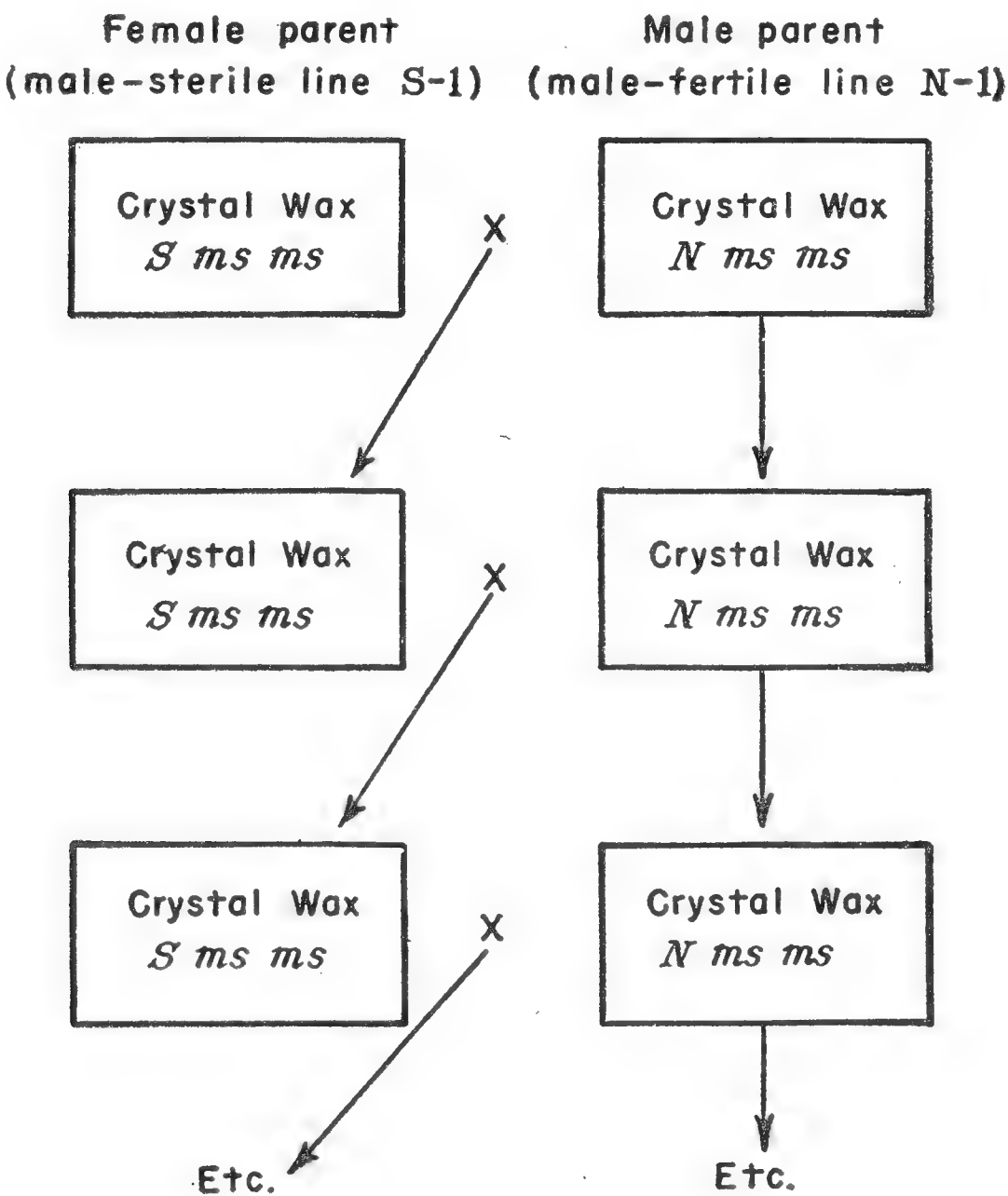


Figure 126. Method of seed perpetuation of a male-sterile line of the variety Crystal Wax. (From USDA Tech. Bull. 874.)

usually rather limited. Being male-sterile, this line cannot be inbred to obtain greater uniformity. Even though inbreds are used as pollen parents in combination with 13-53 the progenies are not as uniform as when both parents are inbreds. The danger of contracting and disseminating the yellow dwarf virus through clonal propagation is ever present. If the mother bulb is infected all the bulbils will also be infected, and these, in turn, may be planted and grown for some time without the disease being recognized.

Despite these difficulties, Italian Red 13-53 is probably destined to be the most important single-bulb selection ever made. As previously

stated, it is being used in breeding for resistance to downy mildew and purple blotch. As a clonal line it is itself being used in the production of hybrid seed, and its male-sterile character has now been transferred to most of the important commercial varieties.

Ever since the discovery of the male-sterile Italian Red 13-53, its limitations when used as a clonal line in the production of hybrid seed has been recognized. Studies have been under way for some time to determine the mode of inheritance of the male-sterile character to determine if it could be incorporated into other varieties and therefore used more widely in the production of hybrid seed.

Inheritance of Male Sterility

Jones and Clark (11) showed that when male-sterile plants of the clonal line 13-53 were crossed with various male-fertile plants three types of breeding behavior were observed in the F_1 generation, some progenies being entirely male-fertile, others entirely male-sterile, whereas still others produced both male-sterile and male-fertile plants in a 1 : 1 ratio.

When a male fertile F_1 plant is selfed the F_2 approximates the ratio 3 normal : 1 male-sterile. When a male-sterile F_1 is backcrossed to the male-fertile parent three types of segregation are obtained as in the F_1 progenies. When the 13-53 male-sterile parent is backcrossed with an F_1 male-fertile plant a 1 : 1 segregation is obtained. In crosses between certain F_1 male-fertile plants used as the female parent and the male-fertile parent line a ratio of 1 male-fertile to 1 male-sterile is obtained. But in the reciprocal backcross when the F_1 male-fertile plant is used as the pollen parent all the progeny are male-fertile.

These results may be accounted for by assuming that the male-sterile condition results from an interaction between a nuclear recessive gene and a non-nuclear or cytoplasmic factor. On this hypothesis it is assumed that there are two types of cytoplasm. All plants with normal cytoplasm (N) produce viable pollen. All male-sterile plants possess the sterile type of cytoplasm (S). The experimental results throw no light on the nature of the non-nuclear or cytoplasmic factor which differs in the two types. A recessive gene for male-sterility (ms) also influences pollen development when carried by plants with S cytoplasm but has no effect when carried by plants with N cytoplasm. Consequently, the 13-53 male-sterile plants belong to the genotype $S\ ms\ ms$. Plants with N cytoplasm are male-fertile always and may belong to the genotypes $N\ Ms\ Ms$, $N\ Ms\ ms$, or $N\ ms\ ms$, since the ms gene has no effect in the N cytoplasm. Plants with the genetic constitution $S\ Ms\ Ms$ and $S\ Ms\ ms$ will also be male-fertile, in spite of the S cytoplasm, because they carry the dominant gene Ms .

The non-nuclear or cytoplasmic factor is inherited only through the egg (maternal inheritance) and not through the male parent, presumably because of the very small amount of cytoplasm present in the male gamete. From the cross $S\ ms\ ms \times N\ Ms\ Ms$ all F_1 plants will be $S\ Ms\ ms$ and, in spite of the S cytoplasm, will be male-fertile because they carry the gene Ms . $S\ ms\ ms \times N\ ms\ ms$ will give all male-sterile, and $S\ ms\ ms$

x $N Ms ms$ will give 1 male-sterile : 1 male-fertile. When a male-fertile F_1 plant($S Ms ms$) is selfed, the expected F_2 ratio is 3 normal : 1 male-sterile.

All male-sterile F_1 plants belong to the genotype $S ms ms$ and behave the same as the original male-sterile parent. When the 13-53 male-sterile parent is backcrossed with an F_1 male-fertile plant, $S ms ms \times S Ms ms$, a 1 : 1 segregation is expected.

When an F_1 male-fertile plant, $S Ms ms$, is used as the female parent and backcrossed to $N ms ms$ a ratio of 1 male-fertile to 1 male-sterile is obtained. But in the reciprocal backcross $N ms ms \times S Ms ms$ all of the progeny are male-fertile, since all carry N cytoplasm. The unlike behavior of these reciprocal backcrosses is critical evidence in support of the validity of this hypothesis.

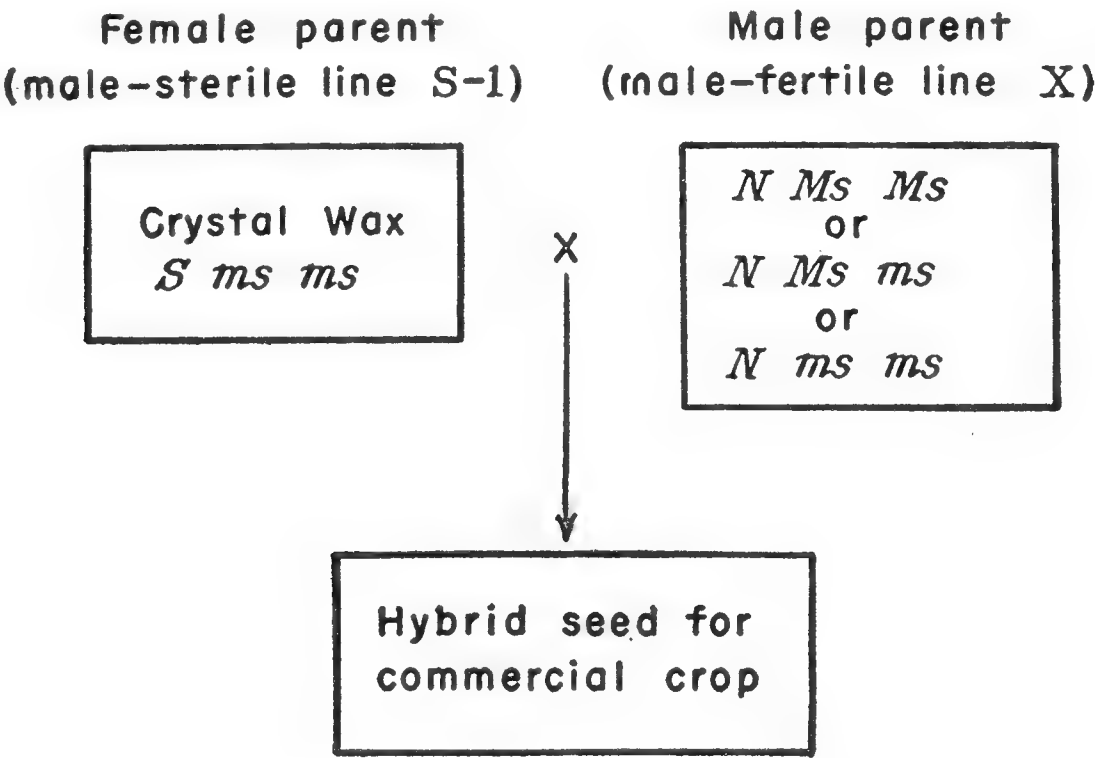


Figure 127. Method of producing hybrid seed for the commercial onion crop. (From USDA Tech. Bull. 874.)

Second backcrosses of the type $S ms ms \times N Ms ms$ gave a 1 : 1 segregation. Second backcrosses of the type $S ms ms \times N ms ms$ gave all male steriles. This confirms the expectation that 100 percent male-sterile progenies can be obtained in repeated backcrosses to a stock with the genetic constitution $N ms ms$. As will be shown later, this is of great practical importance in developing a breeding program.

Practical Utilization of Male Sterility

Male-sterile lines have now been developed for practically all the important commercial onion varieties by crossing with Italian Red 13-53. Fortunately, male-fertile plants with the genotype $N ms ms$ have been found in most varieties so far tested. The only means of determining whether a fertile line is pure for $N ms ms$ is by a breeding test. The method of incorporating the male-sterile character of Italian Red 13-53 into different varieties is illustrated graphically in Figure 125, the variety Crystal Wax being used as an example. The rate at which the Crystal Wax genes are incorporated into the male-sterile line is some-

what faster than indicated in Figure 125, because in all the backcross progenies selection is for the Crystal Wax type. The numbers given in the figures show the rate expected for random sampling. After being backcrossed two or three times to the male-fertile parent, the male-sterile and male-fertile lines appear almost identical.

The production of hybrid onion seed of all types and in quantity is now possible. To perpetuate the pure male-sterile line two lines (a male-sterile line of the genotype $S\ ms\ ms$ and a fertile line of the genotype $N\ ms\ ms$) must be carried along. All the progeny of this cross will be male-sterile. Figure 126 illustrates the method of perpetuating the male-sterile line through the seed.

As the male-sterile plants cannot be selfed, seed is obtained by continually backcrossing to the normal, or male-fertile, line. Backcrossing continues as long as the particular male-sterile line is to be perpetuated. After a few backcrossings the male-sterile line should be practically identical with the male-fertile except for the sterility factor of the cytoplasm. This backcross seed makes it possible to perpetuate the male-sterile line, as well as to produce the male-sterile female parents used in the production of hybrid seed.

The next step is to make crosses between the male-sterile line and other selected lines to determine which combination produces the best commercial hybrid (Figure 127). The constitution of the male parent that enters into the cross for the production of commercial hybrid seed may be $N\ ms\ ms$, $N\ Ms\ ms$, or $N\ Ms\ Ms$, the particular one selected being based on progeny tests. The behavior of the commercial hybrids as to fertility is not important, because the commercial onion crop must be grown from hybrid seed each year. It is important, however, to get a favorable combination of growth factors.

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CHROMOSOME BEHAVIOR AND FERTILITY OF COLCHICINE—INDUCED TETRAPLOIDS IN ALLIUM CEPA AND A. FISTULOSUM

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The common onion, *Allium cepa* L., and the Japanese onion, *A. fistulosum* L., both have eight pairs of chromosomes, but they are characterized by different types of pairing during meiosis. At first metaphase the chiasmata of the chromosome bivalents of *A. fistulosum* are interstitial and localized at the kinetochore, whereas in *A. cepa* they are terminal or subterminal. An amphidiploid between these two species has been reported by Jones and Clarke (3)¹. The experiments with colchicine reported in this paper were undertaken to obtain material for a study of chromosome behavior in autotetraploids of the two *Allium* species and to compare such behavior with that found in the amphidiploid.

Materials and Methods

Three onion varieties were used in this study: Nebuka, a type of *Allium fistulosum*; Creole, a variety of *A. cepa*; and a backcross line of *A. cepa*, namely, (male-sterile 13-53 x Crystal Wax) x Crystal Wax. For convenience this backcross line will be referred to in this paper as the male-sterile backcross. The genetics of male sterility and a method of producing male-sterile lines have been described by Jones and Clarke (4).

At the suggestion of P. C. Burrell seeds of each of the three varieties were sown onto blotters which were moistened with distilled water and placed in a seed germinator at 19.5° C. Germinating seeds of each variety were selected for treatment before the protrusion of the radicle, as well as after the radicles had attained lengths of 1 millimeter, 2 to 5 millimeters, 5 to 10 millimeters, and over 1 centimeter. In addition, seeds germinated directly in colchicine were used in the experiment. For each of the four colchicine solutions there were therefore 6 different lots of germinating seed, making 24 treatments for each variety. In addition, a control lot of untreated seeds was planted. Each lot consisted of 22 seeds, so that in all 550 seeds were planted for each variety.

Four colchicine solutions were used to induce tetraploidy: Aqueous solutions of 0.1 percent and of 0.5 percent colchicine, with and without morpholine. Morpholine is a wetting agent or penetrant and was included to determine if it favored the production of tetraploids by promoting a more rapid penetration of colchicine.

The germinating seeds were placed for 3 hours in vials containing the aqueous solutions of colchicine. The solution was then decanted and

¹ Italic numbers in parentheses refer to Literature cited at end of article. the seeds were washed twice in distilled water. The seeds to be germin-

ated in the colchicine solution were placed in petri dishes on blotters moistened with colchicine solution, allowed to sprout, and then washed in distilled water. The untreated seeds were placed in distilled water for 3 hours to eliminate any difference in time of soaking between them and the

TABLE I.

Number of onion seedlings alive 6 weeks after treatment with colchicine. Twenty-two seeds or seedlings were planted in each lot.

Variety	Strength of aqueous colchicine				Development at time of treatment
	0.1%	0.1% + morpho- line	0.5%	0.5% + morpho- line	
Nebuka -----	18				Seed germinated in colchicine.
Nebuka -----	15	0	3	0	
Creole -----	17*	0	0	1	
Male-sterile backcross ----	13	0	2	2	
Nebuka -----	19	17	15	17	Seeds swollen.
Creole -----	18	19	17	21	
Male-sterile backcross ----	18	18	20	21	
Nebuka -----	13	0	6	0	Radicle 1 mm.
Creole -----	10*	0	10*	3	
Male-sterile backcross ----	10	0	1	0	
Nebuka -----	12***	0	5	0	Radicle 2 to 5 mm.
Creole -----	17**	0	3	0	
Male-sterile backcross ----	4	0	4	0	
Nebuka -----	12	0	2*	0	Radicle 5 to 10 mm.
Creole -----	1	0	0	0	
Male-sterile backcross ----	9	0	0	0	
Nebuka -----	7****	0	1	0	Radicle over 1 cm.
Creole -----	2	0	0	0	
Male-sterile backcross ----	1	0	1	0	
Number of untreated seedlings					
Nebuka -----	18				
Creole -----	20				
Male-sterile backcross ----	17				

* The asterisks indicate where 13 of the 18 tetraploids occurred. Each asterisk indicates one tetraploid plant. Data for 5 plants were lost.

treated lots. Immediately after treatment each seed or seedling was planted in a thumb pot in sterilized soil.

When the plants were 3 months old the average size of the stomata of each treated plant was determined and compared with that of the check plants. A small piece of epidermis was peeled and mounted in aceto-carmin. The length of the guard cells was measured by means of an ocular micrometer. Care was taken to compare stomata from leaves as near the same age as possible and from the same relative position on each leaf. Twenty-five measurements were made for each plant. For cytological studies, propiono-carmin smears of pollen mother cells and of first microspore divisions were used. All plants having a constant haploid count of eight chromosomes in the first microspore division were discarded. At first, pollen mother-cell smears from tetraploid plants were made in the usual way, but later Clarase was used to obtain a better spread of the chromosomes, as described by Stuart and Emsweller (7).

All seed heads of tetraploid plants were bagged and selfed, using flies to ensure pollination, as described by Jones and Emsweller (5).

EXPERIMENTAL RESULTS

Approximately 25 percent of the germinating seeds survived transplanting after being treated with colchicine. Six weeks later 407 plants were living. The number of living plants in each lot 6 weeks after planting is given in table I. Of these plants, 8 Nebuka, 7 Creole, and 3 male-sterile backcross plants were classified as tetraploids.

Sixteen of the eighteen tetraploids were from the 0.1 percent colchicine treatment. Five of the tetraploids were from seedlings with radicles over 5 millimeters long. The percentage of killing was higher, however, in these lots having the long radicles. The mortality among the swollen seeds was no greater than among the untreated seedlings.

The amount of killing was noticeably greater after treatment with 0.5 percent than with 0.1 percent colchicine. Addition of a drop or two of 1-percent morpholine solution also greatly increased the mortality. An analysis of variance showed that this increase in the amount of killing exceeded the 1-percent level of significance both for strength of colchicine and for the addition of morpholine. Differences among varieties, however, were not significant.

The gametic number of chromosomes in both *Allium cepa* and *A. fistulosum* is 8, the number being doubled, of course, in the tetraploid plants. At the first postmeiotic division of the microspore in the tetraploid Nebuka plants the chromosome count varied from 13 to 20, the greatest number of microspores (42 percent) having 16 (table II). Two microspores had the reduced haploid number of 8. Sometimes a small chromatin body, possibly a chromosome fragment, was also present, but such cases have been omitted from the table. Metaphase plates during the first postmeiotic division of the microspore in the autotetraploid *A. fistulosum* are illustrated in Plate 272.

TABLE II.

Number of chromosomes counted at the first postmeiotic division in the microspore of the Nebuka onion.

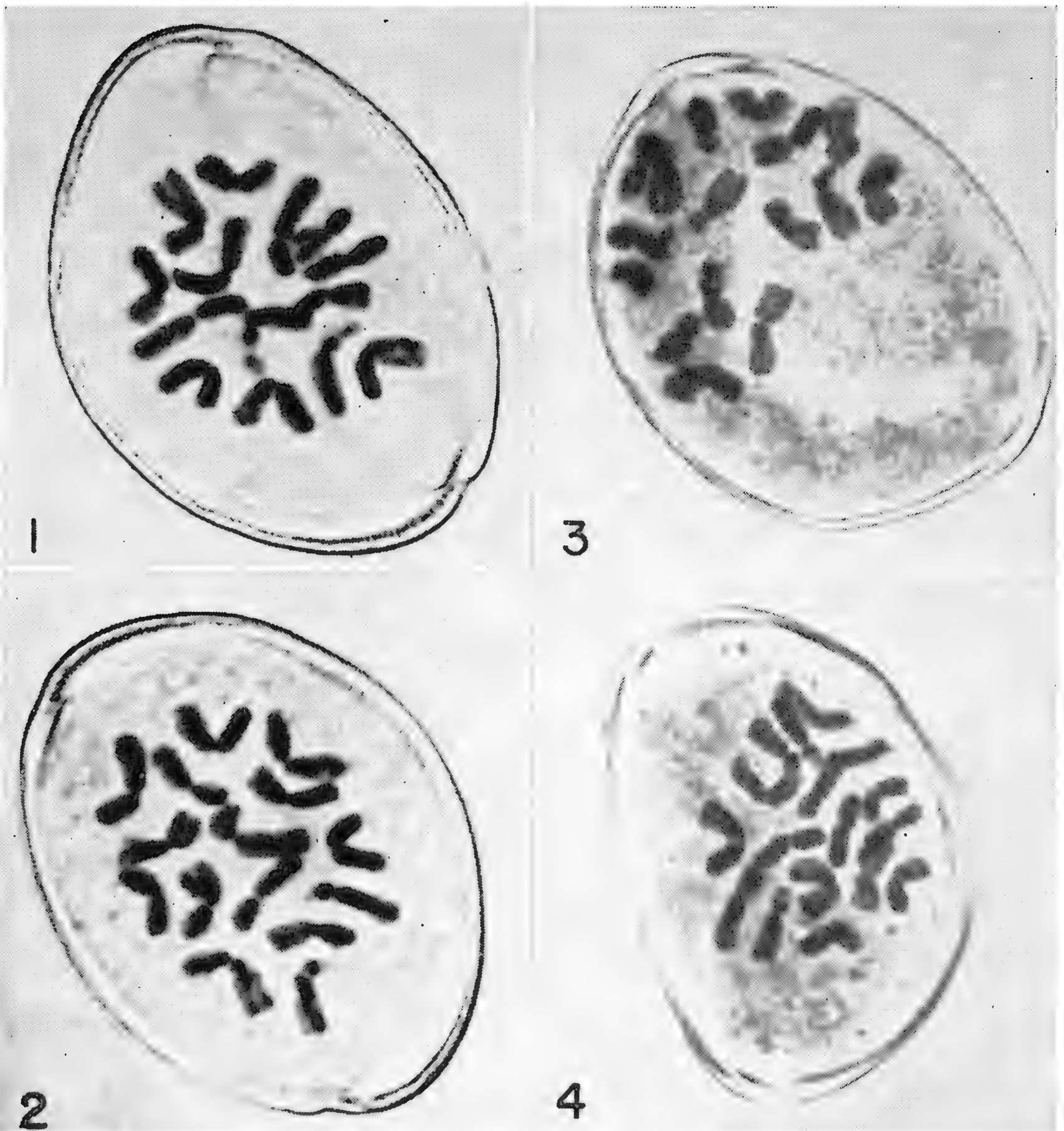
Number of chromo- somes	Frequency	Percentage
8	2	1.3
13	4	2.5
14	15	9.6
15	26	16.6
16	66	42.0
17	32	20.3
18	8	5.1
19	3	1.9
20	1	.7
	<hr/> 157	<hr/> 100

Tetravalents, trivalents, bivalents, and univalents are found at the first meiotic metaphase in the tetraploid plants (Plate 273). Chromosomal irregularities are more common in *Allium cepa* than in *A. fistulosum*. In a count of 91 cells of *A. cepa* tetraploid the number of multivalent associations (quadrivalents and trivalents) per cell averaged 6.5, whereas in a count of 103 cells of an *A. fistulosum* tetraploid they averaged only 2.5, this difference being sufficiently great to exceed the 1-percent level of significance. Univalents are also more frequent in *A. cepa* than in *A. fistulosum* tetraploids.

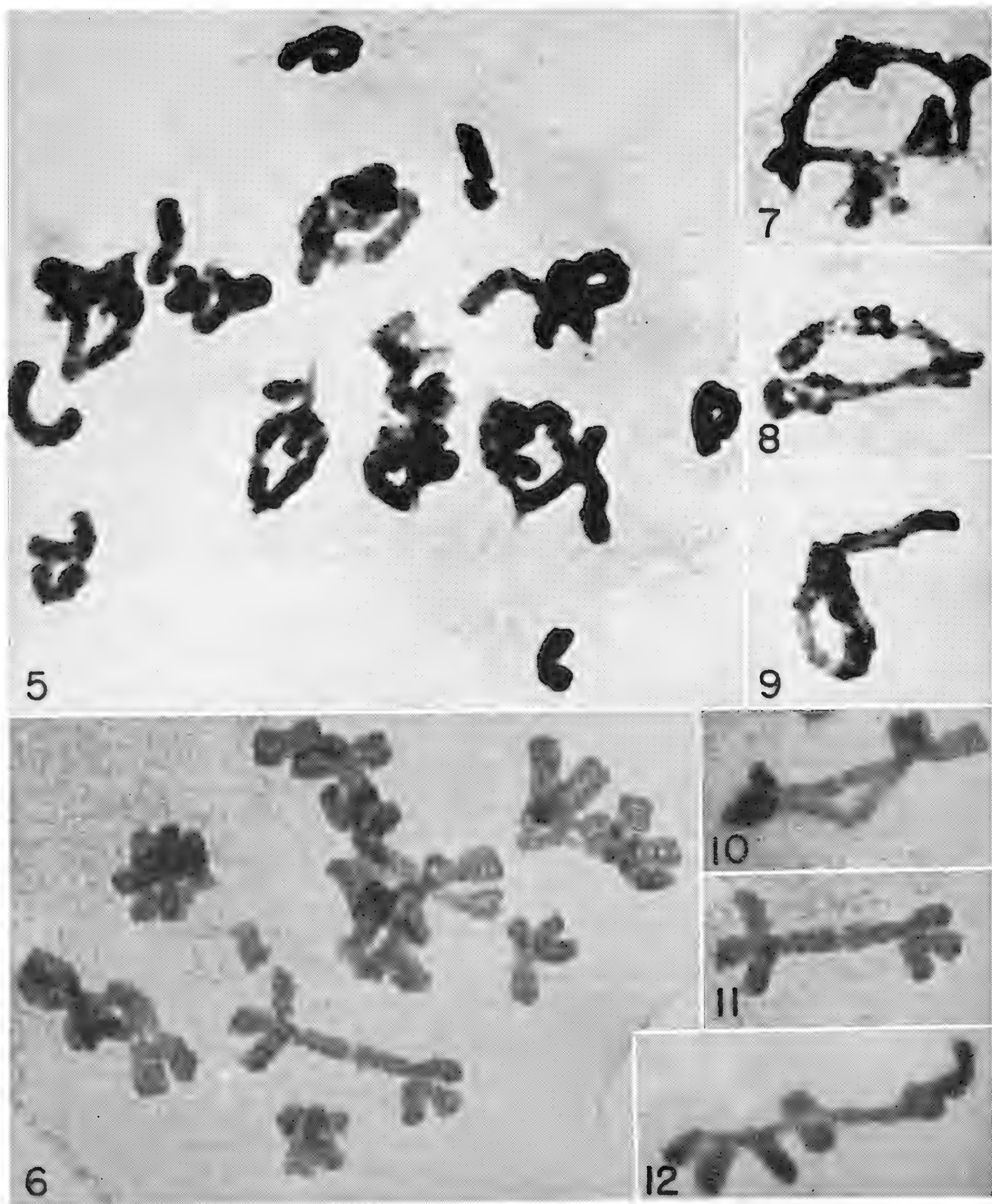
The quadrivalents formed in the two species differ in appearance as illustrated in Plate 273. In *Allium cepa* they form a variety of rings or chains held together by terminal or subterminal chiasmata, whereas in *A. fistulosum* the most common type of quadrivalent consists of two localized pairs of bivalents joined together by a terminal or subterminal chiasma.

The tetraploid plants were characterized by larger pollen grains. Fifty Nebuka diploid pollen grains average approximately 36 microns and 50 tetraploid pollen grains 42.5 microns in length. Of a total of 1,253 pollen grains counted from several tetraploids, the percentage of pollen grains that were normal in appearance and presumably fertile varied from 40 to 68 percent. Two-thirds of the plants set seed.

The number of seeds per head in the autotetraploids ranged from 3 to 66. These seeds were planted in the fall of 1942 in the greenhouse, and the seedlings were examined in the spring of 1943. With the exception of 2 progenies all the populations were tetraploid, the individual plants giving counts of ± 32 chromosomes. One Creole plant yielded both diploid and tetraploid offspring, indicating that the inflorescence consisted of mixed tissue. One Nebuka plant yielded only diploid progeny. It is possible that this plant was erroneously classified as tetraploid, but more likely it was partly diploid and partly tetraploid, the inflorescence developing from diploid tissue.



First postmeiotic division in the microspore of tetraploid Allium fistulosum; metaphase plates showing (1) 14 chromosomes, (2) 15 chromosomes, (3) 16 chromosomes, and (4) 17 chromosomes.



Chromosome pairing during first reduction division in tetraploid *Allium Cepa* and *A. fistulosum*; (5) first meiotic metaphase in tetraploid *Allium Cepa*, showing type of chromosome pairing; (6) first meiotic metaphase in tetraploid *Allium fistulosum*, showing type of chromosome pairing; (7 & 8) quadrivalents in *Allium Cepa*; (9) trivalent in *Allium Cepa*; and (10 to 12) quadrivalents in *Allium fistulosum*.

The size of stomata was unreliable as a criterion for the preliminary determination of tetraploids. Some tetraploids when 3 months old did not have larger stomata than the diploids of the same variety, but of four tetraploids measured at maturity three had stomata larger than those of the corresponding diploids. Three of the plants examined had both large and small stomata on the same leaf, those of different sizes being restricted to definite portions of the leaf.

DISCUSSION

In treatments to induce polyploidy in onions, the best response seems to be obtained by applying colchicine to the plant in the very young seedling stage in order to get the material into the meristematic tissue of the growing point of the stem. In the embryo the stem plate is located just above the tip of the radicle, and when the latter has elongated only a few millimeters the stem has already been carried outside of the seed coat. At this early stage the stem tip is surrounded only by the cotyledon. As the seedling develops, true leaves are differentiated from the stem apex, thus the growing point becomes more and more deeply embedded, and it becomes increasingly difficult to get the colchicine to the growing point.

Treating swollen onion seeds with colchicine before emergence of the radicle is not effective as such an application yielded no polyploid plants. Table I shows that this particular treatment is the only one in which mortality was not high, either from colchicine or from morpholine. This is probably due to the lack of penetration by these agents through the seed coat to the embryo. With the exception of this group, every lot representing different protruded lengths of radicle gave at least one tetraploid plant.

The chromosome pairing in these autotetraploids is very different from that found in the amphidiploid hybrid, *Allium cepa* \times *A. fistulosum*, described by Jones and Clarke (3). In the latter, multivalent associations were not found at first metaphase, and the pairing of the bivalents was quite regular. In the hybrid tetraploid described by Levan (6), polyvalent associations occurred but their frequency at first metaphase averaged less than one per cell. In the *A. cepa* and *A. fistulosum* herein reported averages of 6.5 and 2.5 polyvalents, respectively, were found.

The difference between the amphidiploid and the autotetraploids in regularity of chromosome pairing results in a marked difference in fertility. As shown by Jones and Clarke (3) the amphidiploid regularly forms 16 bivalents and is highly fertile. Regular formation of bivalents, however, does not necessarily result in high fertility, as Greenleaf (2) has reported an amphidiploid in *Nicotiana* which has regular chromosome pairing but is completely female-sterile. In our autotetraploids the chromosome pairing was much more irregular than in the *cepa-fistulosum* amphidiploid and the plants were highly self-sterile, although most of them did produce a few seeds. Undoubtedly the meiotic irregularities are largely, if not entirely, responsible for this.

Levan (6) studied meiosis in *Allium porrum* and found almost complete localization of pairing. He considers this species an autotetraploid. Quadrivalents were formed rather frequently during prophase but were rarely found at first metaphase since they generally separated into two bivalents before that stage was reached. Quadrivalents in this autotetraploid were undoubtedly less frequent than in autotetraploids with a random distribution of chiasmata, as in *A. cepa*. Darlington (1) had previously suggested that a reduction in number of quadrivalents is to be expected in tetraploids with localized chiasmata.

In the autotetraploid *A. fistulosum* reported in this paper the percentage of quadrivalents at the first meiotic metaphase is significantly less than in the autotetraploid *A. cepa*, but the number is nevertheless much higher than in *A. porrum*. The behavior of this autotetraploid shows that it is possible to obtain an autotetraploid with the localized type of chromosome pairing which can, nevertheless, form a substantial percentage of quadrivalents at first metaphase.

SUMMARY

1. Autotetraploids of both *Allium cepa* and *A. fistulosum* were produced by treating germinating seeds with 0.1 and 0.5 percent aqueous colchicine for 3 hours.

2. A study of chromosome behavior during meiosis in autotetraploids showed that quadrivalents, trivalents, and univalents are more frequent in *Allium cepa* than in *A. fistulosum*.

3. Quadrivalents in the *Allium cepa* tetraploid form a variety of rings and chains held together by terminal or subterminal chiasmata, whereas those in the *A. fistulosum* tetraploid usually consist of two localized pairs of bivalents joined together by a terminal or subterminal chiasma.

4. These autotetraploids are highly self-sterile, owing to meiotic irregularities in chromosome behavior, but some seeds were obtained after self-pollination.

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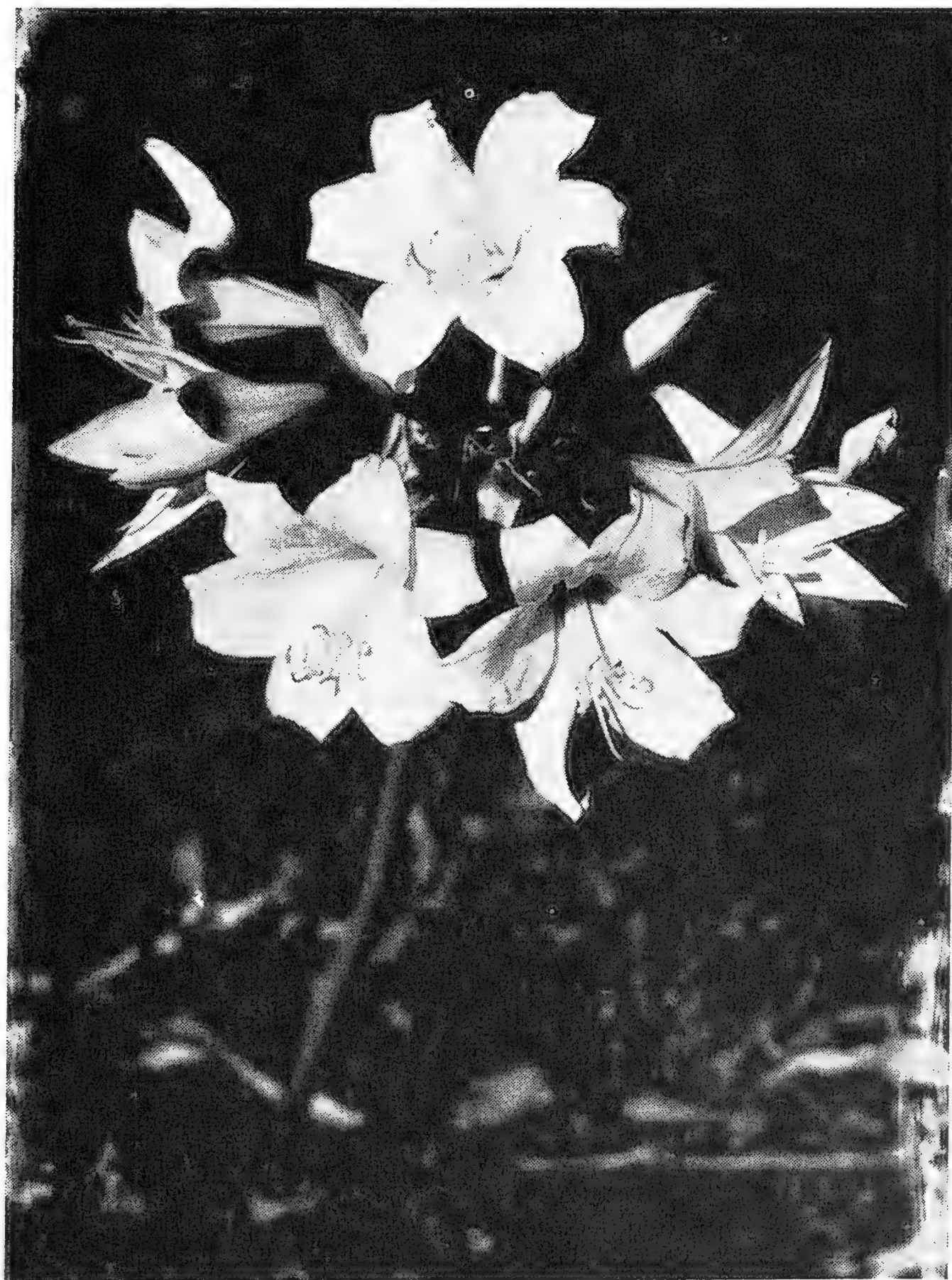


Figure 128. *Hybrid Brunsvigia—Hathor*. Photo by L. S. Hannibal

AMARYLLIS BREEDING REPORT, 1944

HERMON BROWN, *California*

This report is not as favorable a one as the writer would like to make. He has not had the required labor due to the war effort. Weeds have grown up in his Amaryllis beds, and many seedlings have not been transplanted. The Public was not invited to see the flowers in bloom due to the gasoline shortage. However, the closer neighbors did come to visit us during Amaryllis Time.

The writer has raised a lot of fine hybrid seedlings in flats that are doing nicely. The seedlings blooming for the first time were interesting. Two new beauties have appeared—an Azalea Pink and one with white tepals edged pink, and with green throat. The seedlings from crosses of light red on pure whites are excellent—light pink with faint markings, dots or lines. These are more beautiful than the pure whites. Another year is awaited with anticipation.

Apparently every Amaryllid breeder has some excellent clones that that he would not sell or otherwise dispose of. However, he will have more pollen from such plants than he can use. This season the writer has both sent out and received pollen from such plants. Pollen can be placed in gelatine capsules, and packed in small pasteboard boxes for mailing. With reasonable care the pollen will be viable for a week or two. It is suggested that the breeder receiving the pollen send back to the cooperating breeder half of the seeds from each matured capsule produced from such crosses. The writer would like to see the plan tried, and is willing to cooperate with other breeders. His address is Gilroy, California.

HYBRID BRUNSVIGIA—HATHOR

L. S. HANNIBAL, *California*

Hathor is probably one of the finest *Brunsvigia* hybrids available (Figure 128). H. B. Bradley, a nurseryman in Sydney, Australia, developed it some 40 years ago. Since it multiplies rapidly it has come into wide use through many Australian gardens, being more popular than the old Cape Belladonna, *Brunsvigia rosea*. The parentage is uncertain, but it is assumed that one parent was a Bidwell *Multiflora* Hybrid (*Brunsvigia Grandiflora* X *Brunsvigia rosea*) and the other may have been *Parkeri* (*Brunsvigia gigantea* (Van Marum) Traub X *Brunsvigia rosea*).

G. K. Cowlshaw in Vol. 2, HERBERTIA, reports that it never produces seeds, but both the writer and Mr. W. M. James at the trial garden have noted otherwise. In fact the seeds are one of the most interesting things about the plant. Many of us are acquainted with the large fleshy seeds of the Cape Belladonna, but few have seen the seeds of *Eubrunsvigias* which are seldom larger than a small garden pea, and just as round. When selfed *Haythor* produces three types of seed; the first being the large albuminous irregular seed of the Cape Belladonna type,

usually 5-10 mm in diameter and rose pink, the second group is small (under 5 mm. in diameter), round, and colored a mottled rust red, and the third and larger proportion of the seed are intermediate between these two extremes, being slightly irregular and colored deep rose minutely spotted with a rust red granulation. It is not often that we see the manifestation of Mendel's Law as applied to the F-2 generation in the seed stage, but there is little doubt here. Out of 222 seeds, 30.5%



Figure 129. *Crinum* clone—Frank Leach. Photo by L. S. Hannibal.



Two *Hemerocallis* flower scapes with open flowers showing several degrees of the quilled-petal character.
(For full description see opposite page.)

were the *Eubrunsvigia*, 38% were intermediates, and 31.5% were of the Cape Belladonna type. These seeds are now in the 1 leaf stage. It is a bit premature to make predictions, but their development is being watched with keen interest.

Haythor should be better known in California gardens. Its open umbel of many large krinkly white blossoms makes a striking appearance, and the yellow eye deep in the throat of the flower offers a contrast that no other hybrid *Brunsvigia* so far has equaled.

A QUILLED-PETAL CHARACTER IN DAYLILIES

A. B. STOUT

The New York Botanical Garden

There is a clone of daylilies in cultivation which has in some of its flowers what may be called quilled-petals. Ramets of this particular clone were obtained by the writer in 1925 from the nursery of C. G. van Tuber-gen, Jr., and in 1926 from the Royal Moerheim Nurseries in Holland, and also in 1930 from Carl Purdy in California. All these plants came under the name "*Hemerocallis aurantiaca major*." This clone is, I judge, a hybrid of the *H. Dumortierii* and the so-called "*H. aurantiaca Major*." The foliage has the evergreen habit of growth but the plant is much more hardy than the clone that is the true *H. aurantiaca Major*. The flowers are clear orange in coloring and they resemble the flowers of *H. Dumortierii* in shape but are somewhat larger.

In a fully quilled petal the two sides of a petal are inrolled and overlapping especially at the base. Often the quilled petals stand in front of one or more of the outer set of stamens. Both or only one of the two lateral sides of a petal may be inrolled and there are gradations in the degrees of inrolling as shown in Plate 274. There is variation in the number of petals that are quilled in a flower and there is irregularity from day to day in the relative proportion of normal flowers and quilled flowers. The quilled feature is hence decidedly fluctuating in expression.

Description of Plate 274. Two scapes with two open flowers showing several degrees of the quilled-petal character. In flower to the left one petal is strongly quilled and the other two are somewhat inrolled. In the flower at the right, one petal is nearly normal, but the others are more or less inrolled, and three of the normal stamens stand between the sepals and the petals.

The flowers resemble those of *H. Dumortierii* in shape but are somewhat larger. The scape is coarsely but rather compactly branched and bears empty bracts below the inflorescence. These features are characteristic of the F₁ hybrids that the writer has obtained from the cross *H. Dumortierii* X *H. aurantiaca Major*.

Occasionally a flower of this clone has an extra petal and sepal (pseudo-double). When all of the petals in a flower are strongly quilled the effect somewhat simulates doubleness, but thus far petalody has not been observed in any of the flowers of this clone. During the years that

ramets of this clone have been grown at The New York Botanical Garden they have produced no capsules. A considerable number of flowers have been self-pollinated. No cross-breeding has been attempted with this clone. Possibly the quilled character would have some value if it became complete and constant for all petals of all flowers of a clone. Thus far the quilled character has been observed in no other daylily.

It is possible that it was this clone that gave rise to a report that was evidently first printed in the Cyclopedia of American Horticulture, edition of 1900. This brief statement is as follows:—"H. *Dumortierii* var. *flore pleno* (H. *disticha pleno* Hort.)." There is no description. The synonym given suggests confusion with the true *H. fulva* clone *Flore Pleno*. This mention was continued in the later editions of this Cyclopedia of Horticulture, but in the latest edition of the latter there is omission of the synonym. In the treatment of *Hemerocallis Dumortierii* in "Hortus" there is no mention of a double-flowered clone, and Dr. L. H. Bailey made no reference to such a clone in his treatment of *Hemerocallis* in 1930 (*Gentes Herbarum* 2:143-156.). I have not located any information that can serve as the basis of the above references to a double-flowered clone of *H. Dumortierii*.

The clone with the quilled petals is, I judge, of no value as a garden plant, but possibly its quilled character may have some potential value for use in breeding, especially if it could be combined with the petalody of true doubleness.

CRINUM—FRANK LEACH

L. S. HANNIBAL, *California*

This fine plant was first described last year. It is by far the largest of the *Crinum Moorei* strain. The blossoms are a blush pink and over ten inches long, and in Figure 129 one can see how the scape towers well above the meter stick placed beside it. Several plantings have been reported about the San Francisco Bay area, so the plant is not exactly rare, but it is not common to the trade. From its size and indifferent seedling habit we are inclined to consider it a tetraploid, although this is not proved. As far as we know such has not been reported previously in *Crinum*, but it is not impossible, and it may be of value in hybridizing in the future.

DAYLILY BREEDING IN IOWA

VIVIAN CHRISTENSON, *Iowa*

The writer is trying for a near white daylily but so far, of the seedlings that have bloomed, the palest were poor in quality or type of flower. It takes a good flower not to burn in the hot sun and wind that are experienced here. This season the writer shall use *Moonbeam* and *Starlight* and will keep trying for a near white.

The writer also is trying to produce some large dark shades. Some dark ones have been secured but they seem small. This season *Potentate*, and next season *San Juan* will be used as parents.

Last summer a glowing orange seedling, which always blooms at Iris time, flowered again in July and *Fulva Rosea* was used as a pollen parent on it in the hope that some worth while colored seedlings may be secured. *Fulva Rosea* seedlings grown in the house, were set out in May 1942. Fifty of these seedlings bloomed in July 1943. In August 1943, 250 seedlings were set out that may bloom this year, and an additional 350 seedlings were planted out in May of this year. The soil in the writer's garden is rich black loam, mellow. It is necessary to cover the seedlings for the first winter or they will heave out. The seedlings are also shaded during the hottest part of the summer.

The writer's best seedlings are the following: No. 15, *Soudan X Fulva Rosea*, 5-inch flower, withered rose, even color with thin pale cream line around segments; No. 5, brilliant copper self produced by a deep goldenglow yellow smoothly burnished Rufous Orange-velvet; No. 7, segments Yucatan with star of De Medici Purple which blends into the Yucatan coloring.

4. PHYSIOLOGY OF REPRODUCTION

THE DISTRIBUTION OF THE MALE-STERILITY GENE IN VARIETIES OF ONION

T. M. LITTLE, *formerly assistant geneticist*, H. A. JONES, *principal olericulturist*, and A. E. CLARKE, *associate cytologist*, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture.

Male sterility in the onion was first reported by Jones and Emsweller (1) in a planting of the variety Italian Red. Jones and Clarke (2) found that the inheritance of male sterility resulted from the interaction of a cytoplasmic factor with a nuclear factor. The gene for male sterility is capable of expression only when it is associated with the male-sterile cytoplasm, and it appears to have no effect whatsoever on plants containing normal cytoplasm. Moreover, plants with male-sterile cytoplasm are male-sterile only when they contain two recessive genes for male sterility, one or two dominant male-fertile alleles being sufficient to produce male fertility.

Though such a gene is rather unique because it has no apparent effect on the plants with normal cytoplasm, there is probably little, if any, natural selection brought to bear either for or against plants possessing this gene. It is therefore of interest to know how this gene is distributed among the commercial varieties of onion. The answer to this question is also important from the point of view of the plant breeder, as it has been suggested that the male-sterile lines of various varieties be developed for use in producing hybrid seed.

Plants of the original male-sterile clone, designated as Italian Red 13-53, and its male-sterile descendants have been crossed with plants from nearly all the important commercial varieties. From the breeding behavior of these crosses, the genotype of the pollen parent was determined with respect to the $Ms : ms$ factor pair. If both male-sterile and male-fertile plants appeared in the hybrid progeny, it was certain that the genotype of the pollen parent was $Ms ms$. If five or more male-sterile plants appeared in a progeny and no male-fertile ones, it was considered that the genotype of the pollen parent was $ms ms$, the probability of obtaining a 5:0 ratio from an $Ms ms$ plant being only about 3 percent. Likewise, populations containing five or more male-fertiles and no male-steriles were interpreted as coming from a pollen parent with the genotype $Ms Ms$. Populations containing four or less plants, all of the same phenotype, do not give conclusive evidence as to the genotype of the pollen parent, but do eliminate the possibility of the pollen parent belonging to the alternative homozygous genotype. The results of these investigations appear in table 1.

It will be seen that out of 29 varieties tested, 25 contained both the Ms and the ms gene. One of the two varieties containing only the ms gene, Stockton G-36, is known to have arisen from an individual plant

selection which evidently had the constitution *ms ms*. In the other, Southport Yellow Globe, only one plant has been tested, and further testing may bring to light the presence of the *Ms* gene in this variety. The thrips-resistant strain of Australian Brown is descended from a single plant that doubtless had the constitution *Ms Ms*, and the single plant of Australian Brown designated as *Ms ms* is in doubt, as only one male-sterile plant appeared in a population of 14.

One of the most interesting facts brought out by these tests is the occurrence of both the *ms* and the *Ms* gene in the shallot. Though this form is usually given specific rank as *Allium ascalonicum*, many authorities consider it to be only a variety of *A. cepa*. It is, however, widely different from other varieties of *A. cepa* in many respects.

Table 1

Frequency of different genotypes involving the *Ms : ms* factor pair among commercial varieties of onion, as indicated by crossing with male-sterile Italian Red 13-53.¹

Genotype of plants used as pollen parents

Variety	<i>ms ms</i>		<i>Ms ms</i>		<i>Ms Ms</i>	
	<i>ms ms</i>	<i>ms ms</i> or <i>Ms ms</i>	<i>Ms ms</i>	<i>Ms ms</i> or <i>Ms Ms</i>	<i>Ms Ms</i>	
Stockton G-36	19	0	0	0	0	
Southport Yellow Globe	1	0	0	0	0	
Italian Red	7	0	1	0	0	
Southport White Globe	17	0	3	0	0	
Yellow Bermuda	7	3	1	0	0	
Crystal Wax	45	1	11	1	3	
Utah Sweet Spanish	12	0	8	0	0	
Brigham Yellow Globe	13	2	4	0	2	
Red Rocco	1	0	1	0	0	
Early Yellow Globe	8	2	7	1	1	
Colorado #6	3	1	7	0	0	
Creole	25	1	32	0	7	
Scott County Globe	0	1	2	0	0	
California Early Red	0	0	1	0	0	
Red Wethersfield	0	0	1	0	0	
Shallot	0	0	2	0	0	
Yellow Danvers Flat	0	0	1	0	0	
Ebenezer	0	0	3	1	0	
San Joaquin	0	1	2	0	1	
Crystal Grano	0	1	6	0	2	
White Portugal	1	0	7	0	3	
Golden Globe	0	0	1	1	0	
White Grano	0	0	1	0	1	
Lord Howe Island	0	0	1	0	1	
Mountain Danvers	0	0	2	0	3	
Early Grano	0	0	1	0	3	
Australian Brown	0	0	1(?)	0	23	
Do, thrips resistant	0	0	0	0	33	
Burrell's Sweet Spanish	0	0	0	0	1	
Total	159	13	107	4	84	

¹ Arranged in order of the proportions of *ms* genes indicated for the varieties.

The widespread occurrence of both the *Ms* and the *ms* genes throughout the varieties of *Allium cepa* indicates that the mutation (presumably from *Ms* to *ms*) took place a long time ago, or else has taken place more than once; otherwise, the *ms* gene should be found in comparatively few varieties. The nearly equal frequency of the two alleles further indicates that in the presence of normal cytoplasm, there must be practically no selection for or against plants possessing the *ms* gene. The fairly large proportion of heterozygous plants found leads to the conclusion that there is considerable natural cross-pollination among onions, for a high degree of selfing would tend to eliminate the heterozygotes in favor of the two types of homozygotes.

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5. AMARYLLID CULTURE

REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION,
USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.

ORNAMENTAL ALLIUMS FOR NORTH AMERICAN GARDENS

A SYMPOSIUM

(This symposium on ornamental alliums for North American gardens was arranged by Sgt. Bernard Harkness, Chairman, Allieae Committee, who is now in the U. S. Armed Forces. Under date of March 18, 1944, he sent some notes which are reproduced below.—*Editor*)

1. *Allium* Notes

SGT. BERNARD HARKNESS

Francis Marion Fultz in his book, *Lily, Iris and Orchid of Southern California*, published in 1828, points out that there are a score of alliums native to that region though frequently passed over as most of them are not outstanding. He names *Allium haematochiton* as the most common on the dry foothills. Its rosy-purple flowers on six to ten inch stems are attractive except as they begin to fade. This species is not mentioned in Grey's *Hardy Bulbs* as grown in England. As representative of high mountain species Mr. Fultz speaks of *Allium tribracteatum*—its rose-pink and white flowers appearing in solid patches on the higher mountains in the northern part of Ventura County. *A. tribracteatum* is mentioned in most of the *Allium* literature; Grey classes it as "quite worth growing in a sunny rock garden." Representing the desert species in the book is *Allium fimbriatum*. Mr. Fultz's locale for it is "almost anywhere around the borders of Antelope Valley," where the flowers vary from rose to purple, with some white. It is grown in England as Grey recommends a light sandy soil in full sun. Seven photographs of the above and other alliums are included in the book.

It is interesting to note that from two Canadian gardens, F. Cleveland Morgan's (HERBERTIA, 1943) and F. L. Skinner's at Dropmore, Manitoba, (article in present symposium), *Allium zebdanense* is recommended. The locale for *A. zebdanense*, so-named by Boissier and Noe, is given as near Bebdan, in Lebanon, and in Turkish Armenia. I find Zebdan(y) to be a village on the map of Syria between Damascus and Beirut at close to 6,000 feet elevation. C. H. Grey recommends it as one of the best of the white-flowered species but notes that it requires an extremely-dry, well-drained position if it is to survive for any length of time.

2. *The Decorative Onions*

HELEN M. FOX, New York

Some of the decorative alliums are exquisite in their daintiness and come in charming hues. *Allium flavum*, *pulchellum*, and *caeruleum*

brighten the rock garden when the spring refulgence has become dimmed while *glaucum* var. *senescens*, with its silvery pink blossoms, is harmonious with the greys of herbs as is the grey-white *tuberosum*. Here in North America the native onions form part of the colorful spring tapestry of western meadows along with brodiaeas, calochortus, camassias and erythroniums, or are found springing up in woods.

Many gardeners do not like the odor of allium, describe it with unpleasant adjectives and nouns and bar it from the garden. It is true that all flower garden alliums with few notable exceptions, such as *tuberosum* and *flavum*, smell like their cousins, leek and garlic. Though almost all people in the whole world like the flavor of onion in their food, the odor is not popular in gardens. Even the enthusiast for the decorative members of the Genus *Allium* must admit it would be unpleasant to have a whole garden smell of them, yet a whiff here and there between the spice of carnation, the tang of savory and sweetness of the rose has the virtue of contrast. Moreover, with a few exceptions, onions do not give off their smell without first being touched. People who do not know the decorative onions are always surprised when told they are cousins of the leek and it is the smell that convinces them, so it has its place.

The onions increase rapidly under cultivation and many species are so hardy they are likely to become pests, but it is a simple matter to dig up superfluous clumps. Just the same, as with all plant collecting, it is difficult to procure certain species. So often a form of something already present in abundance comes up when a rarity has been ordered and waited for with breathless suspense. This is one of the hazards of eclectic gardening that cause the final attainment of a rare species to be all the more appreciated.

Seeds of many species bloom the second summer and some are biennial and have to be renewed from seed and almost all of them can be increased by dividing the clumps. Instead of ripening seeds some of the onions form little bulblets where the flowers should be. If these bulblets are planted, the new plants will in all likelihood again bear a harvest of knotty, green lumps instead of flowers.

The comparatively few species grown by me did not seem sufficient for an article to interest the public so I have read the writings of other gardeners to find onions they thought attractive, and have consulted various authorities. Louise Beebe Wilder—Adventures with Hardy Bulbs—has done a thorough piece of research and has grown many of the bulbs herself. For American onions there are notes in Ira N. Gabrielson, Western American Alpines; Joseph E. Harned, Wild Flowers of the Alleghanies; Leslie L. Haskin, Wild Flowers of the Pacific Coast; and Anderson McCully, American Alpines in the Garden. For European onions there is Hippolyte J. Coste, Flore Descriptive et Illustrée de la France, de la Corse, et des Contrées Limitrophies; and for scant but accurate notes Clarence Elliott, Rock Garden Plants; as well as Reginald Farrer, The English Rock-Garden; and of course L. H. Bailey, Hortus; as well as the herbarium and botanical literature at the New York Botanical Garden.

Onions grow wild over the northern hemisphere. The slender spears rising from bulbous roots are among the earliest greens to appear in woods and meadows in spring. Later in the season, stems grow up bearing umbels either round or flat, full or sparse, with more or less colorful flowers. Certain wild onions besides *Allium Cepa*, the usual table onion, leek, garlic, chives, Welsh onions and ciboule have been gathered for food. Some of the wild onions are sweeter than others but this article is concerned only with the decorative members of the genus.

There are some charming native American onions. Among the North Western species is the handsome *Allium acuminatum*, Hooker's Onion, often so prevalent it is like a weed in dry sandy soil of sage brush slopes and open meadows from British Columbia to Idaho and California. It is hardy, as is true of so many western plants, only, where there is no winter wetness. The bulb coats are netted, the flower stem 8-15 inches high and near its base grow the short leaves. The flower heads are in good proportion to the scape which is one reason the plants are so good looking. The full umbel is composed of bell-like flowers with the tips of the segments slightly reflexed, colored purple, varying to soft pink, and on stalks slightly longer than the perianth. According to Ira N. Gabrielson they cover mountains and plains with the purple mist of their bloom in June and July. Two papery bracts of iridescent pink and white enclose the flower clusters before they open. As the blossoms age they fade to a lighter tone. They last long after being cut and those left standing in pastures and along hillsides retain their bright color after the summer grasses have dried.

Also from the North West, Washington, Colorado and south to New Mexico and Texas, grows *Allium Geyeri*, a woodland onion partial to high altitudes. The bulbs have fibrous coats, the leaves are very narrow and two-thirds the length of the scape which is about 10 inches or more high. From June to September the heads of rose, some say flesh colored blossoms, with broad, oval segments and awl-shaped filaments, are borne on fleshy pedicels a little longer than the flowers.

From the same region and similar to *Geyeri* is *Allium falcifolium* only that it grows in full sun, blooms the end of May and has very differently shaped leaves. These are 6 inches or so long and twist along the ground as do leaves of some species of tulips. The flat scape carries an umbel of purple-tinged-pink blossoms, held erect, with prominent white anthers not longer than the petals which are slightly reflexed. The leaves disappear before the flowers mature.

A species of dry hillsides growing in coarse granite sand in California and Nevada, is *Allium atrorubens* with a habit of sending up one leaf only. The scape is 5 inches high with umbels almost 2 inches across, composed of stalks the same length as the flowers, which are reddish, tinged with a deeper purple tone.

An upland bog plant is *Allium brevistylum* blooming in June in the high mountains of Utah, Wyoming, Montana and Colorado. The rootstock ends abruptly and is crowned by one or more bulbs with many dead coats. The scape is 1-2 inches thick, and obscurely winged. The

narrow leaves are half as long as the scape, which is from 12-15 inches and carries a showy umbel of roseate pink blossoms borne on pedicels twice their length. The filaments are deltoid at their bases. Since it requires moisture, *brevistylum* might be grown at the edge of a stream.

In California and Baja California grows the fairly tall *Allium unifolium*, which is probably not hardy. It is described as 2 feet high with bright umbels of many fairly large rose pink flowers borne on pedicels twice their length. The leaves are shorter than the scape.

According to Leslie L. Haskin, *Allium attenuifolium*,¹ of the Pacific Coast, is the most beautiful of wild onions and grows in many types of situations, though another writer, Anderson McCully, says it needs dry soil and sun. The outer coats of the small, round, truncated bulbs are marked with tiny V's on the network. Two radical grass-like leaves with scabrous margins sheath the base of the scape, but leave it close to the ground. The scape is round, about 1 foot high, smooth and glaucous and minutely speckled. A photograph of the plant in Mr. Haskin's book shows a globe-shaped crowded umbel with 50 or more flowers, each with petals separated and star-like. The flowers are described as campanulate-rotate. The stamens are as long as the petals and in color the blossoms vary from white to bright pink.

In April in the Mojave Desert and nearby mountains and also in San Bernardino County of California, *Allium fimbriatum* grows abundantly and is said to be one of the outstanding attractive Westerners. Since it grows in hot dry situations it is not likely to be hardy where winters are wet, drainage poor or cold intense. The thick bulb coats have rectangular markings; there is a thin solitary leaf, longer than the scape which is not higher than 2-8 inches. When the scapes are their shortest the crowded deep rose to purple umbels are sometimes as big across as their support is high. Flower stalks are twice as long as segments while stamens are shorter than sepals. Even in a dried state on a herbarium sheet, the plant looks charming, partly because of the large size of the umbel in relation to the stem.

Another low growing onion, *Allium Nuttallii*, is generally not over 5-6 inches high but sometimes reaches 10 inches or even 15 inches. It blooms from March to June in rocky prairies from Texas and Arizona to South Dakota. The bulb has a reticulated coat, there are a few slender leaves growing from the base of the scape, while the umbel is few flowered, dainty and colored rose or white.

Four onions have grown particularly well in my garden in southern New York and can be recommended for their beauty and hardiness. They are *A. cernuum*, *senescens* var. *glaucum*, *pulchellum* and *tuberosum*. A fifth of equal beauty has not been as long lasting and is probably biennial.

Almost unique among onions because of the sweet fragrance of their flowers are *tuberosum* and *ramosum* natives of Northern Asia. Former-

¹ This is referred to *Allium amplexans* in Morton's Check-List, Herbertia 1940.—*Bernard Harkness*.

ly both came under the heading of *odorum*. In Hortus, Dr. Bailey says *A. ramosum* is distinguished by having hollow leaves, shorter than the scape, the white flowers have a reddish midrib and pedicels 2-3 times as long as the segments. Of *tuberosum* he says it differs from *ramosum* in not having hollow leaves and that the flowers are expanded instead of funnel form, the segments reflexed and marked with an inconspicuous greenish midrib. From seeds I have grown plants to 2 feet high which quickly form large clumps and bloom from July to September and bear umbels of starry white blossoms, that look grey from a distance. I find them handsome because the grey-white blossoms, standing on their tall stems, form accents among the greys of herbs such as artemisias and lavenders, and they are charming as a cut flower with red foliage plants and pink annuals. I call these plants, which came to me as *odorum*, *Allium tuberosum*, because the leaves are not hollow, the flowers are expanded and on the back of each segment is a greenish-lavender line. The bulbs of this onion are cream white with a thin brown sheath. The grey-green leaves of different lengths are linear, thick and all joined one inside the other to the scape. They stand up to 1 foot or a little more, like flat narrow green ribbons and are $\frac{3}{16}$ inches across. The flower umbel, $2\frac{1}{2}$ inches across, is subtended by a paper like bract, and carries about 40 flowers, $\frac{1}{2}$ inch across on stalks of 1 inch or so. The flowers are greenish-white, have pointed perianth-segments, and anthers, brown when ripe. The flowers mature quickly but other umbels keep coming along so the bloom lasts fairly long. To me, as well as to Mrs. Wilder, the blossoms have a fragrance reminiscent of heliotrope, but only if one smells them without touching, for as soon as this happens, the odor of onion pervades the air, like an enchanted princess in a fairy story.

Spread over the whole of North America and variable in height, shape of leaves and color of flowers, is *Allium cernuum*. The narrow clustered bulbs are oval at the base and have reticulated coats, tinted tan-rose. Plants growing in the Rocky Mountains have narrow channelled leaves while in the East they are broad and flattened. My seed came from the West so the leaves are slightly concave, and narrow and from 3-12 inches high. They are pointed at the apex and held in place by brown magenta bracts. They cluster around the base of the scape and all leave it at the same point about 1 inch above the ground. The tallest and biggest plants 12-18 inches high come from Virginia and the Middle West. The scape is ridged, $\frac{1}{8}$ inch wide, flat and two-sided. In my garden the bell-like flowers, $\frac{3}{8}$ inch long, bloom in September, in the Middle West from July on to September. They grow in nodding umbels on dark, green pedicels $\frac{1}{2}$ inch or more long. The 3 inner segments are shorter than the outer. The color has been described as rose lavender, but in mine the buds begin pale green, then are overcast with violet and lastly open to a lovely tone of pale pink. The whole inflorescence is graceful and lasts a long time in flower.

In contrast to all the pinks are two yellow onions, *Allium flavum* and *Allium Moly*. I have never been able to procure *Moly* though I have sent repeatedly for seeds and bulbs. It comes from southern Europe, is hardy and has been an Old World garden plant for centuries.

The bulb is ovoid, the leaves are 2 inches wide, and the flowers golden yellow with the perianth enclosing the ovary. A sketch of the plant in Coste's book shows it to have few-flowered umbels of starry flowers.

Also from southern Europe, and hardy, comes the exquisite *Allium flavum* forming dainty clumps in the flower border or rock garden and blooming in July in full sun with flowers fragrant of Lily-of-the-Valley. The brittle, glaucous, blue-green scapes, 1 foot high, grow out of long hollow or semi-circular leaves that envelope the base. Before the umbel emerges it is enclosed in an ecru paper-like, ribbed envelope. After the envelope opens the tips of it, like 2 insect feelers, turn down and a cluster of tiny yellow bells appear borne on stalks of different lengths, yellow in color but with a green tinge. The bells hang down or stand up with the still unopened buds among them and give the effect of a minuscule, windblown fountain. The umbel measures 3 inches across, each floret $\frac{3}{16}$ inch. Stamens and pistils protrude beyond the segments. The whole umbel, because of the pointed feeler-like tips of the bracts, seems to be in motion, *Flavum* sets seeds readily and a new batch is grown every year as the plants are not long lived.

Except for its color, *Allium pulchellum*, from southern Europe and Western Asia, is very like *flavum*. In my garden it blooms in July and August and is renewed constantly from seed. The scapes are 1-1½ feet high, glaucous, blue-green as are the leaves which clasp the stalk at the base and are rounded at the tips. The flower head is fountain-like, more dome shaped than in *flavum*, and opens out of two spathe-like leaves, one shorter than the other which persist and stand out at fantastic angles. The umbel is 4 inches high and 2½ inches across. The stalks are colored like the flowers, a roseate lavender or, according to Ridgway's Color Chart, "mallow purple" shaded "phlox purple." The effect is a Victorian color, a dusty light plum. There is no scent until the flowers are touched and then ———!!!

The scape and umbel of *Allium caeruleum*, formerly called *azureum*, and coming from Siberia and Turkestan, is bright steel blue, a most unusual color. The shape of the plants resembles chives. The triangular leaves are yellow green, long and linear and lower than the scape and grow almost parallel to it. In my garden plants were 18 inches high but Dr. Bailey says they grow to 4 feet. Sometimes two flower stalks grow out of one spathe. The rounded umbel is 1¾ inch across, "greyish violet blue" is the color of the segments but the presence of many unopened buds on green stems gives a slaty tone to the whole. The stalks of fully open florets are violet tinged and much longer than the blossoms which are $\frac{1}{4}$ inch across. A dark line runs down the centre of the segments. Though unpleasant to record, the flowers smell of a combination of onion and perspiration. They bloom in June and are handsome to have in a distant corner perhaps close to pink beebalm where color and scent will harmonize and quiet the hard effect of the onion.

Coming in August and September and therefore doubly welcome, is *Allium senescens* var. *glaucum*, called narcissus-leaved garlic. The bulbs are $\frac{3}{4}$ inch or more across, tinted purple, with a thin integument, and

form thick clumps in a few years. The leaves grow in clusters, are concave, twisted, as if made of two thicknesses, about $\frac{1}{4}$ inch across and 12 inches or less long. The scapes are ridged and hollow and rise to 2 feet carrying heads of dusty lavender or mauve pink. In the var. *glaucum* the flowers are more campanulate and the umbels denser than in the type. The umbels of my plants measure about 2 inches across and are spherical. The pedicels are longer than the flowers which measure $\frac{3}{8}$ inch across. These flowers open violet and fade to pale pink and give the effect of being "pale amparo purple." The anthers are dark lavender before the pollen ripens, when they turn yellow and since they project beyond the segments they help color the whole umbel as well as to give it a feathery lightness. The plants are odorless, until they are touched.

Two South European onions to be grown where the climate is warm and dry sound entrancing. The first *Allium narcissiflorum*, also known as *pedemontanum*, is described as the showiest of the family, with nodding, fairly large flowers of brilliant purple borne on scapes 1 foot high. It blooms in July in lime stone mountains of south and eastern France and northwestern Italy. The bulbs make large clumps and are covered with dense fibre. The upstanding leaves are strap-like, broad, numerous and 6-9 inches high. They sheath the base of the scape and leave it at the same point about 3-4 inches from the ground level. The flowers 2-10 in an umbel, grow on short pedicels and are campanulate, shaped somewhat like *Campanula carpatica* with points at the centre of the wide segments which overlap at their bases. Each flower measures from $\frac{3}{4}$ inch to $\frac{1}{2}$ inch across.

The other south European onion *Allium Neapolitanum*, also called *album-santi*, blooms from March to May. Before the war it was picked, tied into bunches and exported to England for decoration. The plants smell faintly and the flowers, in loose heads, are shaped like open cups with wide obtuse segments overlapping at the base. The bulbs have numerous coats, the leaves are flat and wide, oval-obtuse at their tips and similar to daffodil leaves. They are almost as high as the scape which rises to 1 foot and are rough on the margins. The flower pedicels are all the same length and 3 times as long as the blossoms. Stamens and pistils are enclosed in the perianth.

The giant onions are so striking they draw the eye from every other plant in the garden and for that reason I have never grown them. But they are frequently planted in rock gardens or along stream beds but far enough away not to get their roots wet. The hardly *Allium albopilosum* from mountain regions in north Persia and westward in Asia Minor flowers in mid June, with scapes reported 3 feet high. The leaves $1\frac{3}{4}$ inch wide are hairy on their under surfaces, and strap-like. The umbels are huge, from 8-12 inches across, and composed of starry lilac flowers which Mrs. Wilder says have a metallic sheen. The pedicels are 2-3 times as long as the perianths.

From the Himalayas comes the giant of them all, rising to $4\frac{1}{2}$ feet, *Allium giganteum* with leaves 2 inches wide, likely to lie on the ground and a scape bearing globes of bright lilac flowers.

This ends the account of onions with blossoms qualifying them to an honored place in the garden. The ones described are not all hardy in cold, or wet regions, but there are enough pretty onions for every gardener who so chooses to have a variety of them.

3. *Ornamental Alliums in North Carolina*

ELIZABETH LAWRENCE, *North Carolina*

When I am asked to name the three best alliums in my garden, I must first inquire: best for what? If we are choosing the most beautiful I think I must say none. For none of the outstandingly beautiful *Allium* species has ever succeeded with me. *A. validum* blooms sparingly and does not persist, and *A. Moly*—the loveliest of all of the alliums that I have seen—remains a failure after many trials. If we are considering distinction, I would mention *A. albopilosum* first, for the broad heads of metallic lavender flowers are fascinating. For abundance of bloom *A. senescens* would be one of the three, for it blooms from late May to late August, and blooms freely and continuously. But I think that with me the late-blooming alliums fill the greatest need, and therefore I choose *A. subroseum*, *A. tanguticum*, and *A. ramosum* or the plant that grows in my garden under that name.

A. subroseum is somewhat drab in color, but it is dainty enough to make a neat rock plant, and in the South in midsummer, we do not ask too much. It does not appear in *Hortus Second*, so all I know about it is that it takes to cultivation easily, and braves the worst part of the season—late August and September. It is only five or six inches tall with spherical heads of pale lavender (not pink) flowers.

Years ago, Elizabeth Rawlinson gave me *A. tanguticum* as one of the best garden species, and I still think that it is. The pale opalescent flowers are showy only in mass, but the clumps increase rapidly and can be divided frequently. In a few years mine have made a border that is very pretty in July and August, and blooms on into September. And this in a poor part of the garden where there is seldom bloom at any season. Colonel Grey describes the leaves of this species as four to six inches long, and the stems as rather longer. With me the stems are more than a foot tall.

Table 1. Alliums grown, and blooming dates.

<i>Species</i>	<i>Blooming time</i>
<i>Allium Albopilosum</i>	Late April
<i>ascalonicum</i>	
<i>Aschersonianum</i>	Mid May
<i>Beesianum</i>	Failure
* <i>caeruleum</i> (<i>azureum</i>)	May 5-June 7
<i>cernuum</i>	Summer
* <i>cyaneum</i>	Failure
<i>flavum</i>	Mid June
<i>flavum minor</i>	Late June, again in July
<i>globosum</i>	Mid June

<i>karataviense</i>	Failure
<i>Moly</i>	Failure
<i>Mt. Cenis</i>	July
<i>neopolitianum</i>	April
<i>odorum</i>	May
<i>Porrum</i>	Early June
<i>Przewalskianum</i>	Failure
<i>ramosum</i> (tuberosum ?)	Late July to early September
<i>Rosenbachianum</i>	Failure
<i>sativum</i>	
<i>schoenoprasum</i>	May
<i>senescens</i>	May-August
<i>sphaerocephalum</i>	Mid June
* <i>stellatum</i>	Late August
<i>subroseum</i>	August
<i>tanguticum</i>	July-August
<i>tataricum</i>	End of August
<i>triquetrum</i>	April
* <i>validum</i>	End of May

* Did not persist.

The plant that came to me as *A. ramosum* is more like *A. tuberosum* as described by Colonel Grey and in *Hortus Second.* The flowers are not especially fragrant and the segments are keeled with green, not red. Whatever it is, it is a good one. I did not think much of it the first season, but by the second summer it made a very fine showing from late July to early September. The quantities of silvery flowers above the narrow grey foliage were refreshing in the scorched borders. It is the tallest *Allium* I have had, with stems three feet long. From another source I have what seems to be the same plant, as *A. odorum*, and what seems to be the same, but blooms late in May, also as *A. odorum*.

4. *Alliums* of Western United States

LESTER ROWNTREE, *California*

That was a rash moment when I promised Bernard Harkness material on alliums of western United States in the field, for now that I open the *Allium* folder I find a scanty collection of notes and it is never safe to put botanical information down from memory. What sticks indelibly in my mind these caged days, when field work is no longer possible, is the gorgeous wild flower pictures alliums help to make and these recollections bolstered by the folder and botanical manuals must be the source of these notes. Already the remembrance of *Allium* stands in the wild revives my duration spirit and it may be that suggested environmental preferences and associated species may help those who grow onions.

The cold Monterey Peninsula, where our gardens see more fog than sun, is no place for most of the western alliums for though a few of them are found in moist places and one or two are coastal, the majority inhabit hot dry places in the sun. Even *Allium unifolium* which is native not many miles from here and takes more readily to garden conditions than any of the others, drags out, on my wind racked hillside

(where it can get neither hot sun nor moisture nor rich soil), a sadly half-hearted existence. It is not one of the brightly colored alliums but there are sections where it is one of the conspicuous wild flowers of rich grassy meadows, especially when it grows with the tall and brilliant crimson-red fire cracker brodiaea, *Brodiaea ida-maia*, and it is very lovely with wild iris along the sides of streams.



Figure 130. *Allium validum*. Photo by Lester Rowntree

Shelter-loving, moisture-minded *Allium validum* is no more at home here for it is species common to bogs and wet meadows and rivers (Figure 130). In the Oregon Cascades, in the mountains of Washington state and in the Californian Sierra it hobnobs with the tall and strong growing flora of moist places. Architectually beautiful *Sphenosciadium*

capitellatum is one of this community, rising high above the stiff thick, angled, three-foot allium stalks. Further back from the water, the low willows, ledums and twin honeysuckles are pierced by the sturdy racemes of purple-blue *Lupinus columbianus* and the deep bright blue spikes of *Delphinium scopulorum*. Down beside the brown clearness of the swiftly moving stream, right in among the narcissus-like allium leaves the Sierra Rein orchis may be growing and the glistening white flowers and rich lush foliage of grass of parnassus, *Parnassia palustris*, lean over to where moist, dappled frogs, the exact shade of the wet granite, bask silently in the sun.

On the wet rocks of the lower mountains of that collector's paradise, in central northern California where the Trinity, the Scot and the Salmon ranges come together, *Allium amplexans* looks like dainty white or very pale pink thrift with prominent pink anthers and is frequently growing with blue delphiniums. I have found it more often though, especially in Washington and Oregon, with its deep red bulbs sunk in sunny gravelly openings or rock-broken adobe. It is a charming thing with eight-inch upright, red stems capped by rather flat heads of pale pink or white flowers, and in the yellow pine zone it is sweet with *Brodiaea congesta* and *Eriogonum umbellatum*. In drier spots it enjoys being with *Penstemon heterophyllus* but I like it best among the taller squaw-root, *Carum gairdneri*. These two sometimes take over moist clayey May meadows in the lower mountains dappling them with white delicacy, the narrow foliage of the carum covering the nakedness of the allium. *Allium dichlamydeum* is one of the maritime onions and is plentiful on Point Reyes north of San Francisco. It looks something like *A. peninsulare* but is not so tall. The rose colored flower heads are quite compact and the pressed specimens now on my desk are, like most alliums in herbaria, much darker than when they were picked.

One of my pet mountain alliums is *A. falcifolium*, the sickle-leaved onion. If only there were more summer's sun on this hillside it would do well with me for it is fond of loose rocky soil. Its pleasing sturdy blue-green leaves are considerate enough to remain intact until the flattened, succulent flower-stems have developed their bloom. This comes in heavy close clusters which may be rich red-purple, dark wine-crimson or good lavender-pink. Sometimes one finds a pure white form and occasionally, I regret to report, a horrid washed-out pink. Arduous field work, with me, has always been delightfully leavened by that phase of ecology which embraces the association of plants and the gladdening sights of many species of wild flowers growing happily together. *Allium falcifolium* is one which is always found in good company. In the June and July woods of northern California and southern Oregon it joins *Lilium bolanderi* in sunny openings, and *Phlox speciosa*, *Collinsia torreyi*, *Viola cuneata* and *V. lobata* are very likely to be there too. It is nice among the bright and shiny green-leaved lilac-flowered northern form of *Monardella odoratissima* and with its strong determined heads piercing flat, white-flowered mats of prostrate ceanothus. On the mountains of Oregon's Curry County grows the narrow-leaved variety *A. f.*

var. *brevius* and just below the snow line on the June slopes of Mount Shasta as well as in General Grant Park, variety *demissum*, very dwarf, blooms with that perky little solitary or two-flowered dutchman's breeches, *Dicentra uniflora*.



Figure 131. *Allium campanulatum*. Photo by Lester Rowntree.

For an allium, *A. platycaule* is an exceptionally good shade of pink. It grows in high Sierra valleys east of Sacramento, and often on hot slopes with *Lewisia rediviva*. It has flat stems and its narrow petals and exserted stamens give the flower a dainty feathery look. When, by means of feathery petals and protruding stamens, or flowers carried loosely in the head, alliums lose that heavy stodgy look, they become

a great addition to the landscape even though they may not have vivid coloring. *Allium sanbornii* is one of these delicate ones, white or pale pink where, growing on the lower slopes of the northern Sierra, above Grass Valley, a lovely pink form feathers sections of the yellow-pine zone, looking in some lights almost pure light blue and in others a clean soft pink. *Allium campanulatum* is a common species in the mountains of central and northern California (Figure 131). It is not one of the most decorative ones, being a dull lilac and having a white petal stripe which in no way adds to its beauty. In late May and in June it covers the ground very thickly usually keeping to dry places.

If I wanted to see western alliums in quantity I would go to the southwest and follow the slopes which edge the deserts. In such places of grandeur are the best allium pictures to be found. *Allium haematochiton* though not strictly a desert species often grows on these hot and sunny slopes. It is quite common and very lovely having pale rose pink flowers with very deep veinings so that seen en masse the stands seem to be composed of purple blossoms.

In early May strawberry-red *Allium peninsulare* spreads stunning patches across cismontane southern and central California, in pure stands or mixed with other flowers. During the early stages of blossoming there are many shades in these brilliant flecks for the buds are deep mauve and the mature and aging blooms much darker. The stalks are reddish, the pedicels gray pink and the tips of the petals often deep rich crimson. *Allium peninsulare* var. *crispum* is particularly appealing because of crisped inner perianth segments and because these crinkled segments are pure white, contrasting strongly with the rich purple of the rest of the flower. In many places near the desert (Red Rock Canyon is an easy one to reach—if you have gas—), *Allium peninsulare* grows in with the taller, flaming orange-red desert mariposa, *Calochortus kennedyi* and in this sandy rocky ground along with these two may grow yellow pepper grass, *Lepidium flavum*, while the ground beneath these taller plants is brilliant gold with the tufts of two of the desert's composite carpeters, *Syntrichopappus fremontii* and *Eriophyllum pringlei*. Further north, along the Cuyama River Road *Allium peninsulare* joins dark-eyed lilac *Calochortus venustus*, deep purple *Collinsia bicolor*, blue delphiniums and the purple form, and the white of *Lupinus densiflorus*.

The ovaries of *Allium fimbriatum* sport fancy little fringes and give this species the name of fringed onion. It may go down on to the flat floor of the desert and lend its clear rose-pink to sky-blue splotches of *Linanthus parryae* and that dainty little platystemon-like poppy, creamy *Canbya candida*, while above these lower flowers flares glorious *Calochortus kennedyi*. *Allium fimbriatum* var. *mohavense* is a pale pink form found locally on the western slopes of the Mohave Desert.

On the crested onion, *Allium cristatum*, the ovary crests are very prominent. It grows in Arizona, Utah, Nevada and in southwestern California. It is a single-leaved onion—not one of the conspicuous species—and interesting chiefly because the pale flowers, striped with

reddish veins, have a transparent, papery look. Another desert onion, keeping to the Western side and even growing on one of the Santa Barbara Channel Islands, is tall-stemmed *A. lacunosum*, the pitted onion, named because the light brown outer coat of the bulb is pitted by tiny holes which are almost square. The flowers may be deep red-purple but are usually pale pink with dark midveins. In late May one comes across almost wholly unbroken fields of this species. It is quite lovely in the granite rocks of the Kern River Canyon, and particularly striking when it grows in with a flat raspberry-red mass of turking rugging, *Chorizanthe staticoides*.

These few onions of the west belong to a multiform clan. I could go on and on with wild flower scenarios, quite too bedight and lengthy for the pages of HERBERTIA, of other species. Of one thing I am certain, when next, on thick tires and with full gas tank, I take to the byways, instead of hastily posting the bulbs I dig to onion growing friends, I shall first sit down with my microscope and note book and write for my files the bulb descriptions,—coat reticulations and all.

5. Ornamental Alliums for Manitoba

F. L. SKINNER, *Manitoba*

In Manitoba, where winters are both long and severe and the summers hot and sometimes rather dry, the variety of really hardy bulbous perennials is somewhat restricted and we appreciate all the more those hardy species that can be grown under these trying conditions without special care and protection.

The alliums, though not so showy as some of the other bulbous plants like the Liliums, still have some species that in their quiet way are quite beautiful. The following species are well worthy of cultivation in Northern gardens:

Allium flavum from Siberia grows about 9 to 12 inches high, with narrow somewhat glaucous foliage. The yellow flowers are about the size of those of our native *A. cernuum*, with the individual flowers drooping somewhat. Though not one of the showier alliums, *A. flavum* has one decided attraction for those who love fragrant flowers: its blossoms, especially in the evening, have a decided Old Rose fragrance.

Allium Kansuense, from Western China, when not in bloom looks more like a tuft of very dark glossy green grass than anything else. It only grows to 4 or 5 inches tall, and is quite tufted in habit. The flowers, borne on 6 inch stems, are fair size, almost as large as those of *A. cernuum*, but in smaller panicles, and the color is quite a good blue. This, on account of its dwarf nature, is strictly a rock garden species, as it would soon get overgrown by its neighbors in the border.

*Allium odorum*² of Siberia, if it had the clear color of *A. Zebdenense* would be one of the very best of alliums for general cultivation. It grows 20 to 30 inches high, with stiff straight stems, and heads of

² This is apparently *A. ramosum*; not the later flowering *A. tuberosum*, also known as *A. odorum*.—Bernard Harkness.

flowers as large as those of *A. Zebdenense* that have the added attraction of fragrance. The color of the flowers, however, is rather a washy white which cannot compare with the purity of that of an *A. Zebdenense*.

Allium Ostrowskianum, from Turkestan, is one of the easiest grown of the alliums suitable for rock garden cultivation. As it grows in Manitoba it only reaches a height of from 6 to 8 inches high. The individual flowers, however, are of good size, being about one-half inch in diameter, and the panicles, which are held upright, are about 2 inches across. The color is quite a bright rosy red, and with the exception of the root system, this *Allium* very much resembles the European *A. narcissiflorum*. *Allium Ostrowskianum* forms hard firm round bulbs up to fully half an inch in diameter, while *A. narcissiflorum* forms clumps, more after the style of *A. Kansuense*, and in some cases even running under ground to a certain extent.

Allium Zebdenense, from the Mountains of Asia Minor, is one of the earliest of June flowering bulbs that are hardy in this climate. The 2 to 2½ inch broad umbells of wide open cup-shaped flowers are of good form and quite large for this genus, and a glistening white in color. They are borne on very slender and graceful stalks from 12 to 18 inches tall that sway with the slightest breeze. Few people recognize this beautiful little plant as an *Allium* until they are asked to smell a cut stem or leaf. *A. Zebdenense* has small white bulbs, and in suitable good well-drained soil these increase rapidly and soon form wide drifts that are an ornament to any garden fortunate enough to contain them. *Ixiolirion tataricum*, with its bright blue trumpets, flowers at the same time as *A. Zebdenense*, and the combination of blue and white makes a very pleasing picture.

6. Three Alliums for the Great Plains

CLAUDE A. BARR, *South Dakota*

The growing and enjoyment of Alliums in my western South Dakota garden is greatly limited by the conditions of natural moisture supply to which they are of necessity subjected. Of some dozens of species that have been tried only eight or ten kinds endure. These superhardy ones not only undergo extreme cold, with soil either wet or dry, but must withstand the more crucial test of prolonged droughts in the growing time which in this environment often entail total exhaustion of accessible moisture.

Though actual rainfall in this portion of the Plains exceeds that of the famed Matanuska Valley, or of England, factors of altitude, 3250 feet, high proportion of sunny hours, ever active winds and a normally dry atmosphere combine to dissipate at a high rate the store of moisture. Climatic phases thus may vary from highly favorable for growth to unequivocal desert. Obviously, many species are not fully adapted.

Allium nuttalli, native to the Plains from South Dakota to New Mexico and to Arizona, is quite at home in a sandy footing and is a prime

favorite. It is low, eight inches or less, bears its blossoms in May in somewhat lax, upright umbels of a pleasing color which is more than pink but not quite red and above all has no noxious taint of mauve or purple, and they are delightfully fragrant. The slender, terete leaves die down and disappear by Midsummer, a circumvention of the desert employed by many Plains plants.

A charming foreigner is *A. flavum minor* which has been content in the first place offered it, some thirty inches out from the north base of a wall. Here it has full shade but otherwise strong light through several hours of the day, a moderately rich light soil and such moisture as falls. Its color is a distinct attraction and the clear soft yellow umbels have been produced freely and regularly. It grows to eight or nine inches, flowers in late July, its foliage dense, somewhat sedgy in appearance and permanent through the warm season.

My choice of a third favorite is very different, a large plant that I received from the late D. M. Andrews under the name of *Allium recurvatum superbum*, and I believe I had from Mr. Andrews in correspondence the note that it was known as the Pagosa Onion, native only in the neighborhood of Pagosa Springs in the south foothills of the high San Luis Valley in southern Colorado. Hortus Second, as I find, fails to consider the varietal name and of course refers "recurvatum" to *A. cernuum*. But one is impressed by familiarity with this plant that it requires further consideration taxonomically. Its garden effect is wholly different, the leaves nearly flat, a quarter of an inch to three-eighths in width, glaucous, and eight to twelve inches long at maturity. The strong scapes may reach to twenty or twenty-four inches and the July borne umbels of large blossoms are a definite pearly pink carrying a hint of lavender, very handsome. This *Allium* is much at home in the lath house where approximately forty-five percent shade is maintained and evaporation is delayed. In eight years or so a large clump of bulbs has formed and a few seedlings have appeared and thrived in the surrounding clay soil. Its all-summer foliage is a valuable feature.

SOME NUTRIENT DEFICIENCY EFFECTS IN THE ONION

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Little information is available concerning the effect of nutrient deficiencies on plant growth, bulb development, and seed production in the onion, *Allium cepa* L. There is no available information for diagnosing deficiency symptoms in the field. Woodman (7) grew onions in sand supplied with solutions containing (in terms of parts per million) nitrogen 0.41, phosphorus 0.27, potassium 1.12, calcium 0.90, and magnesium 0.25. Deficiencies of nitrogen and phosphorus reduced yields more than did deficient amounts of the other elements. Knott (4) demonstrated that application of copper sulfate to certain New York muck lands resulted in thicker scales and improved bulb color in onions. Fertilizer trials in various sections of the country have produced somewhat variable results, depending upon the soil type and fertility level. In general rather heavy fertilizer applications containing relatively more phosphorus and potassium than nitrogen have been recommended (1, 2, 6). It is known that onions do not thrive on strongly acid or alkaline soils, and lime or sulphur, respectively, have been recommended as correctives (1, 3, 5). Less information is available with reference to specific nutrient requirements for onion seed production. The objectives of the present study were to develop nutrient deficiency symptoms of onion plants and to determine their influence on seed production.

Materials and Methods

In the present study seed of an inbred line of the Yellow Bermuda variety, designated as Texas 986, was planted in 2-inch pots containing burned shale (Haydite) on September 1, 1943. The pots were plunged in Haydite and watered with a complete nutrient solution until November 17. At that date plants selected for uniformity were washed free of shale and planted singly in glazed crocks 4 inches in diameter and 7½ inches deep containing quartz sand. This sand, manufactured by the Pennsylvania Glass Sand Corporation, was of the "F" grade particle size. The plants were watered twice weekly with a complete nutrient solution. This solution, made up in tap water and arbitrarily designated $N_2P_2K_2$, was composed of .002 M $Ca(NO_3)_2 \cdot 4H_2O$, .0005 M $(NH_4)_2SO_4$, .00125 M K_2SO_4 , .000625 M $CaH_2(PO_4)_2 \cdot H_2O$, .002 M $MgSO_4 \cdot 7H_2O$ and contained 2 p.p.m. of Fe, 1.5 p.p.m. of Mn, 0.5 p.p.m. of B, .15 p.p.m. of Zn, .06 p.p.m. of Cu, and sufficient H_2SO_4 to be approximately .0002 N. Additional plants were trans-planted to crocks containing soil composed of 1 part composted soil, 1 part sand, ½ part manure, and ½ part muck.

On January 4 the crocks were separated into 16 lots of 6 each. Two liters of the complete nutrient solution ($N_2P_2K_2$) were applied

twice weekly to one lot of plants and solutions deficient respectively in N, P, K, Ca, Mg, B, Mn, and Fe to 8 other lots. In addition a complete solution ($N_1P_1K_1$) one-fifth as concentrated as the $N_2P_2K_2$ preparation and three other solutions containing very low concentrations of N, P, or K, respectively, were used. In order to compare the effect of different concentrations of calcium without affecting the level of other elements varying amounts of calcium carbonate were applied to three further sets of crocks at monthly intervals by distributing over the surface of the sand. The amounts used were equivalent to solutions containing 15, 75, and 300 p.p.m. of calcium. In these solutions the $Ca(NO_3)_2$ was replaced with NH_4NO_3 and the $CaH_2(PO_4)_2$ with KH_2PO_4 . Additional potassium was supplied by K_2SO_4 . Concentrations of major elements in the 16 solutions are shown in Table 1.

During the winter the greenhouse temperature was maintained at 50° to 55° F. at night and 60° to 65° in the daytime. The plants were sprayed at intervals with derris, nicotine sulfate, and Santomerse in order to control thrips.

Table 1

Calculated concentration of various elements in parts per million of nutrient solution.

Nutrient solution ¹	Nitrate as N	Ammonium as N	P	K	Ca	Mg
1. —N	—	—	38	97	105 ²	48
2. —P	56	14	—	97	105 ²	48
3. —K	56	14	38	—	105	48
4. —Ca	56 ³	14	38 ⁴	97	—	48
5. —Mg	56	14	38	97	105	—
6. —B	56	14	38	97	105	48
7. —Mn	56	14	38	97	105	48
8. —Fe	56	14	38	97	105	48
9. N1 P1 K1	11.2	2.8	7.6	19.4	21	9.6
10. N2 P2 K2	56	14	38	97	105	48
11. N low P2 K2	2.3	0.46	38	97	105	48
12. N2 P low K2	56	14	1.4	97	105	48
13. N2 P2 K low	56	14	38	3.5	105	48
14. N2 P2 K2, Ca 15	28	42	38	97	15 ⁵	48
15. N2 P2 K2, Ca 75	28	42	38	97	75 ⁵	48
16. N2 P2 K2, Ca 300	28	42	38	97	300 ⁵	48

¹ See text for details of preparation.
² Additional Ca from calcium chloride.
³ Nitrate from sodium nitrate.
⁴ Phosphate from sodium phosphate.
⁵ Calcium from solid calcium carbonate.

Seed stalks were produced on some of the plants during April. A hive of bees was placed in the greenhouse to assure pollination. When mature the seed heads were threshed by hand, washed in water, and only the seeds that sank were retained. After air drying, total and 100-seed sample weights were determined for each plant. The seeds were tested for germination under the supervision of Dr. E. H. Toole. They

were germinated between blotting paper, generally in quadruplicate 100-seed tests, at a constant temperature of 20° C. for 14 days. Plants from some treatments produced bulbs instead of seed stalks. When they were mature their air dry weight was determined. These data are shown in Table 2.

Results

Nutrient deficiency symptoms

Nitrogen.—Plants lacking nitrogen grew slowly, became stiff and upright in growth habit with short leaves of small diameter, very light green in color. Later the tips of the older leaves died and assumed a bleached, yellowish color. (Figure 132)



Figure 132. Nutrient deficiency symptoms in onion seedlings. Left to right: Deficient in nitrogen, in phosphorus, in potassium, respectively.

Phosphorus.—Absence of this element was apparent by February 7. First deficiency symptoms appeared as wilting and death of the tips of the oldest leaves. These leaves soon become mottled in appearance, with green islands appearing among yellow and brown tissue as necrosis advanced toward the leaf base. The dead leaves turned black. (Figure 132).

Potassium.—Earliest symptoms of potassium deficiency appeared as a slight yellowing of the oldest leaves. This was followed by wilt-

ing and death of the leaf tips, particularly on the upper side of the leaf. The wilted areas exhibited a satiny texture and the entire leaf dropped, remained somewhat inflated, gradually assuming a crepe-paper-like appearance. Finally the leaves became about the same color as those deficient in nitrogen but retained the crepe-paper-like appearance. (Figure 132).

Table 2

Seed and bulb production in onions grown with different nutrient solutions.

Nutrient solution ¹	No. of plants with seed stalks ²	Wt. of seed per plant	Wt. of 100 seeds	Percent Germina- tion	Mean wt. of bulbs from plants with- out seed stalks
		Mg.		Mg.	Grams
1. —N	6	611	283	94.5	—
2. —P	6	773	268	93	—
3. —K	3	1231	281	92	130
4. —Ca	2	3085	318	92	272
5. —Mg	1	3870	325	97	285
6. —B	0	—	—	—	140
7. —Mn	5	4779	325	95.6	293
8. —Fe	3	5627	335	97.3	273
9. N1 P1 K1	1	1583	275	95	184
10. N2 P2 K2	4	4669	362	94.8	314
11. N low P2 K2	6	1003	266	96	—
12. N2 P low K2	2	1979	285	96	244
13. N2 P2 K low	1	2429	277	97	175
14. N2 P2 K2, Ca 15	2	3622	312	92	251
15. N2 P2 K2, Ca 75	3	4282	302	96	291
16. N2 P2 K2, Ca 300	5	5384	320	96	330
17. Soil	6	2422	307	96.8	—
Mean	3.5	2959	303	95.1	244.8

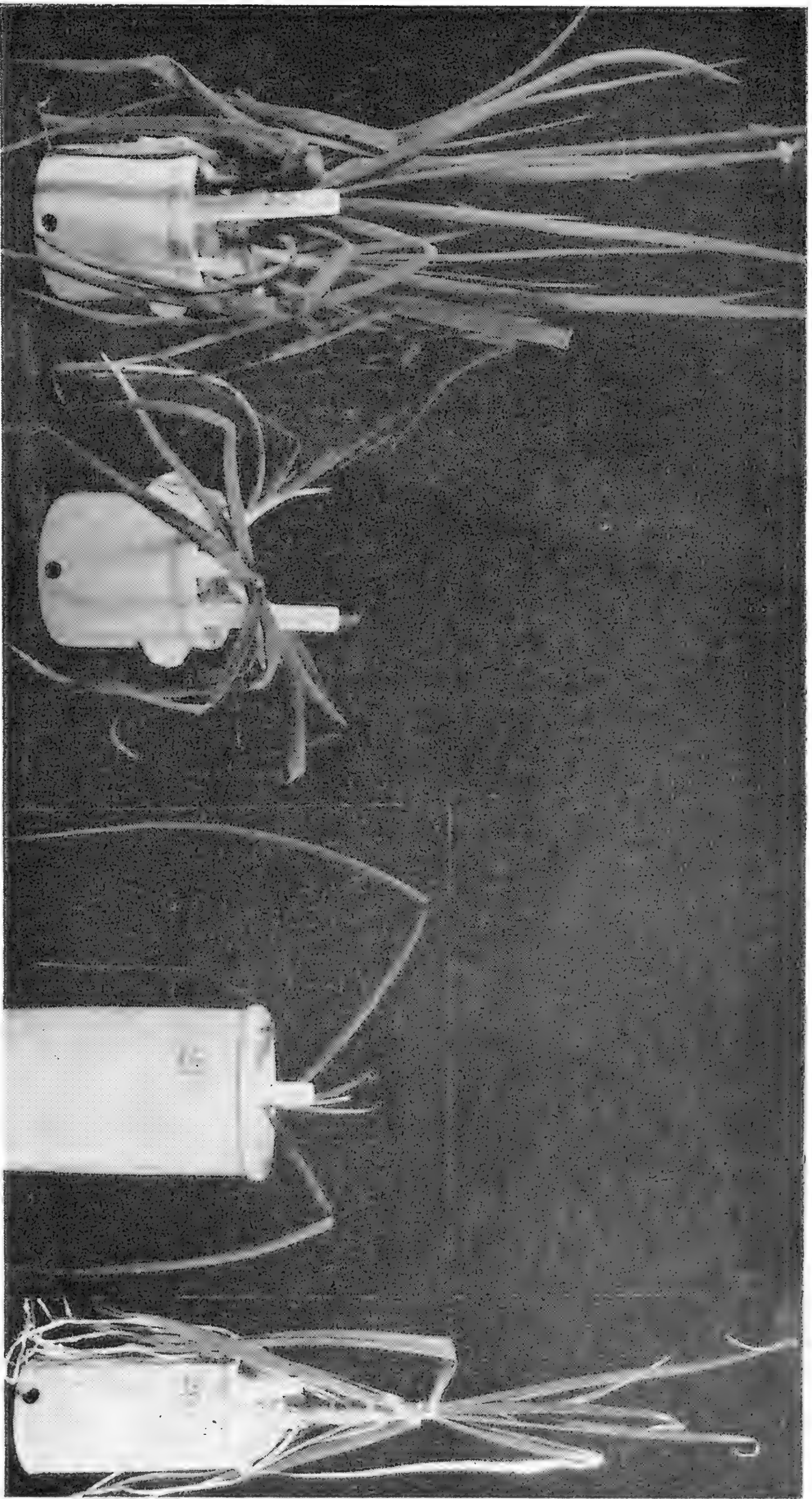
¹ See text for details of preparation.

² Six plants in each test lot.

Calcium.—Preliminary tests with onion plants grown from bulbs as well as seedling plants, to which no calcium was supplied, resulted in death of the youngest leaves, collapse of the roots, and ultimate death of the plants (Plate 275). However, in the present study when calcium was supplied to such plants during their early growth and then withheld, deficiency symptoms were never severe, including death of the leaf tips but no serious reduction in growth.

Boron.—Plants deficient in this element assumed a deep blue-green color. Later the youngest leaves became conspicuously mottled yellow and green and developed distorted shrunken areas. Ladder-like transverse cracks appeared on the upper sides of the basal leaves. These leaves became very stiff and brittle (Figure 133).

Magnesium, manganese, and iron deficiency symptoms were not evident during the present study.



Calcium deficiency symptoms. Left to right: Plant from a bulb, supplied with complete nutrient solution; calcium deficiency in plant from a bulb; calcium deficiency in a seedling; calcium deficiency in a seedling started on complete nutrient.

Effect of Nutrient Supply on Seed Production

Plants watered with solutions lacking boron formed no seed stalks and only small bulbs. Obviously an adequate supply of boron is of prime importance in onion bulb and seed production.

All six plants without nitrogen after January 4 (solution 1, Table 2), all those with very low nitrogen (solution 11), and all those in soil bolted and set seed. However, of plants receiving $N_2P_2K_2$ (solution 10) only four of the six produced seed stalks, while only one plant watered with $N_1P_1K_1$ (solution 9) produced seed. It appears that only a small amount of nitrogen in the nutrient solution is sufficient for seed stalk formation provided the other elements are not also deficient. A large amount of nitrogen accompanied by abundant phosphorus and potassium results in vigorous vegetative growth that is unfavorable for seed stalk formation. It should be added that of the plants producing seed stalks the yield of seed per plant was roughly proportional to the total nitrogen in the nutrient solution ($-N=611$ mg, $N_{low}=1003$ mg, $N_1=1583$ mg, soil= 2422 mg, and $N_2=4669$ mg).

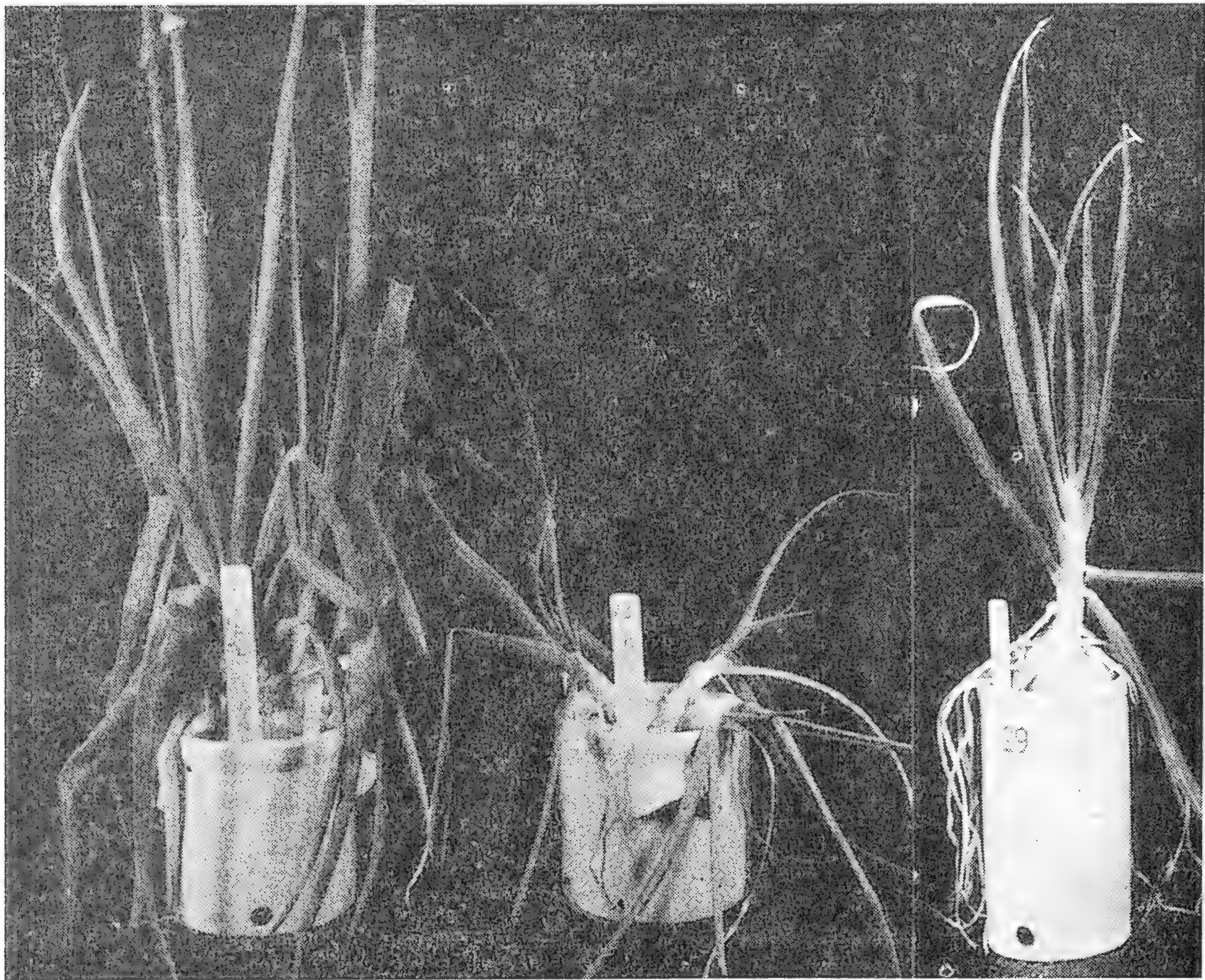


Figure 133. Boron deficiency symptoms. Left, plant from bulb supplied with complete nutrient; center, boron deficiency in plant from a bulb; right, boron deficiency in a seedling started on complete nutrient.

Phosphorus is usually considered to be very necessary for seed formation. Yet in the present study plants that had received no phosphorus (solution 2) for more than 3 months prior to bolting and that showed leaf symptoms of phosphorus deficiency for 2 months of that period, were able to produce seed having a germination percentage of 93 percent. Plants receiving very low phosphorus (solution 12) produced fewer seed stalks but more seed per plant than did those completely deficient in this element.

Absence of potassium in the nutrient solution (solution 3) reduced the number of seed stalks, the yield of seed per plant, and the weight of the bulbs produced by plants that did not bolt. Small amounts of potassium, 3.5 p.p.m. (solution 13), nearly doubled the amount of seed produced per plant.

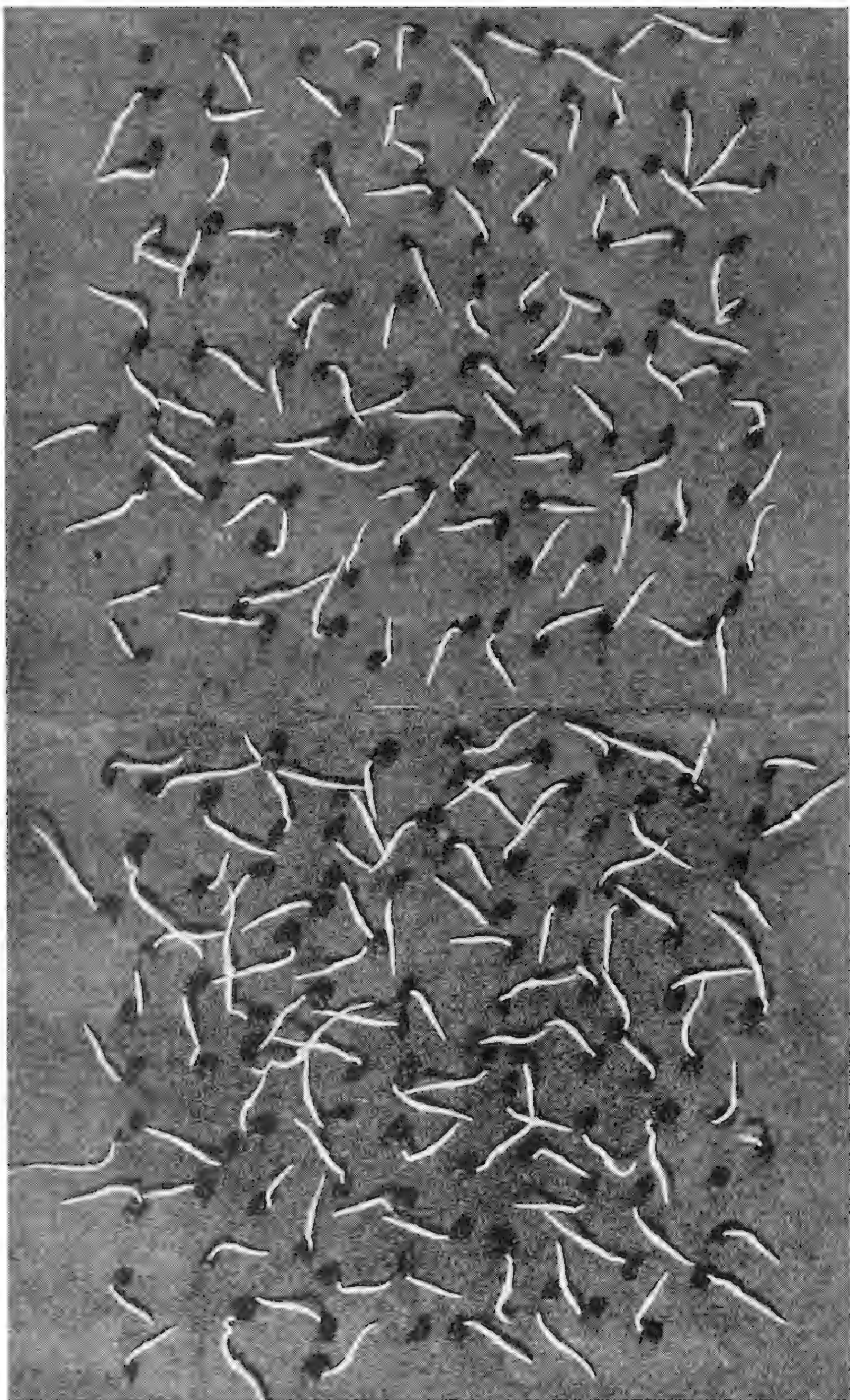
Calcium deficiency appeared to exert less effect on seed production than did lack of nitrogen, phosphorus, or potassium. Where differential amounts of calcium were supplied (solutions 13, 14, and 15), the yield of seed increased with increasing amounts of calcium added.

Half of the total number of plants receiving magnesium, manganese, and iron-deficient solutions produced seed stalks and yields of seed greater than the mean for all treatments. The other plants in these lots produced bulbs larger than the mean bulb weight for all treatments. Apparently the plants absorbed ample amounts of these elements during their preliminary growth with complete nutrient. It is also recognized that the tap water furnished small amounts of these elements, which may have been adequate for their requirements.

The major differences among the treatments were quantitative rather than qualitative insofar as total seed yield and percentage of germination were concerned. There were differences in individual seed weights among the treatments. As shown in Table 2, 100 seeds from the plants deficient in nitrogen, phosphorus, and potassium ($N_1P_1K_1$) weighed 275 mg., while 100 seeds from the $N_2P_2K_2$ treatment weighed 362 mg., an increase of 31 per cent. The difference in seed size as well as in sprout vigor is clearly evident in Plate 276.

Discussion

The strain of onions used in the present study has proved to be resistant to bolting in the field. When grown in the greenhouse under conditions favorable for bolting not all of the plants differentiated seed stalks but some continued to grow and produced bulbs. Formation of a seed stalk instead of a bulb by an onion seedling depends upon genetic and environmental factors. The latter include temperature, photoperiod, and available nutrient supply, plant size being a reflection of the last. The data in Table 2 show that only 56 of 102 plants produced seed stalks. All that did bolt set seed that had a germination percentage above 91 percent. Since there is little difference in quality of seed, the best treatment is the one producing the highest total yield. Most seed was produced by plants receiving the



Germination tests of onion seed. Top, seed from a plant supplied with low level of nutrients (N1P1K1); bottom, seed from a plant supplied with high level of nutrients (N2P2K2).

highest level of nitrogen in the nutrient solution. Evidence from this and from collateral experiments indicates that too high a level of nitrogen during the vegetative growth of the plant inhibits seed stalk differentiation while too low a level reduces seed yield per plant. It would seem that maximum seed yields might be produced by the use of ample nitrogen during the early growth of the plant, by restriction of this element until seed stalks are differentiated, and finally by further applications of nitrogen during seed development. Experiments to test this hypothesis are now in progress.

Summary

Seed of a Yellow Bermuda strain of onion, Texas 986, was planted September 1 and grown in sand with complete nutrient until January 4. At that time 16 series of nutrient treatments were applied until bulbs or seeds were mature. Symptoms of nitrogen, phosphorus, potassium, calcium, and boron deficiencies are described and the influence of these deficiencies on seed yield, weight, and germination is discussed.

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A PERSONAL SELECTION OF DAYLILIES

ELMER A. CLAAR, *Illinois*

For a period of years before the war I took an annual trip to the gardens of the daylily hybridizers and the various daylily trial gardens throughout the United States. With the coming of the war and the advice against traveling I have been unable to make these trips. I miss very much the pleasant times I have had at the homes of the people who hybridize daylilies, and especially in meeting the hybridizers themselves, but I suspect that I am essentially very selfish in that most of these trips were made with the idea of acquiring the fine new things these people were raising. So the report that I make this year has more to do with the daylilies that have come to make their home at my garden rather than seeing something that is being grown elsewhere.

Among the most satisfactory perennials for our garden, with its many trees, is the daylily. Daylilies stand neglect and are free from most insect pests. They thrive with lots of rain or through extended drought. I have seen them grown in all types of soil—rich, poor, acid, alkali, sandy or clay. Daylilies can "take it," but like everything else they do best when you are kind to them. They are available at varying flowering seasons and with a wide range of heights—from one to six feet—and colors—lovely shades like cream, yellow, orange, pink, rose, raspberry, red, maroon, purple and brown; bicolors alternating three petaloid-segments of cherry red, maroon, brown or purple with three sepaloid-segments of yellow, ivory or orange. Many of the individual flowers have a number of different colors. Many have a number of different colors overlapping each other like shot silk. The flowers are large—up to nine inches—and as small as one inch; they are as fine as the finest lilioms. A single scape may have as many as fifty flowers with large numbers of scapes to an established plant. One plant may have several hundred flowers during the season and a profusion of flowers in bloom at one time. It is generally claimed but not true that they are entirely free of insect pests; I have seen some damage done by thrips and Japanese beetles, some varieties winter kill, and I have also seen the leaves of some turn yellow. However, I have found from

experience that most plants have some limitations and that I get a maximum amount of pleasure with a minimum of work by raising day-lilies in our garden, shady as it is. They are at their best when the heat of July and August is here and other favorites are out of season. Buy a few of the new hybrids and you will soon be lustily singing their praises.

If I had no daylilies and I wished to buy a few varieties for a small sum of money, I would select the following:

GROUP I

Early Bloomers (approximately before June 10 in the Chicago suburbs)

Lemon Yellow: *Flava*

Yellow: *Gold Dust*

Orange: *Dr. Regal*

Intermediate Bloomers (approximately between June 10 and 20 in the Chicago suburbs)

Creamy Yellow: *Winsome*

Summer Bloomers (approximately June 20 to August 1)

Light Yellow: *Hyperion* or *Patricia*

Yellow: *Golden Bell*

Orange Yellow: *Ophir*

Orange: *Golden Dream*

Eyed Variety: *Mikado*

Red: *Cissy Guiseppe*

Polychrome: *Fulva*

(*Mikado*, *Hyperion*, *Patricia* and *Ophir* are all near the top of the ten best daylilies selected by a vote of those interested in the flowers.)

Late Bloomers (approximately August 1 on): *Multiflora*

GROUP II

If I wished to add another twelve plants to my collection and keep the additional price down between \$12 and \$15, I would select the following:

Early Bloomers

Yellow: *Flavina* or *Estmere*

Intermediate Bloomers

Orange Yellow: *Queen of May*

Summer Bloomers

Cream: *Moonbeam*

Light Yellow: *Hesperus*

Yellow: *Golden Bell*

Orange: *Mrs. A. H. Austin*

Orange Yellow: *Golden West*

Polychrome: *Linda, George Yeld and Chengtu*

Red Orange: *Imperator*

Bicolor: *Chisca*

Late Variety: *Dorothy McDade*

GROUP III.

The above selection of daylilies, with the first group, could be chosen as standard for the colors involved. If I were interested in some of the new colors such as the pink, raspberry, rose, red, maroon and purple, inasmuch as these are the newer novelties and therefore rare, I would expect to pay more money for them. Among the first plants that were introduced in these color classes, therefore arbitrarily selected by me as typical, are:

Pastel Pink: *Pink Charm*

Raspberry: *Piquante*

Rose: *Fulva Rosalind*

Red: *Emperor Jones*

Maroon: *Wolof*

Ruby: *Royal Ruby*

Purple: *Theron*

If my tastes were not satisfied with the first selections as named in the above group, I would make a comparison of the pastel pink, *Pink Charm*, with *Sweetbrier, Heather Rose, Dolly Varden, Sri Chandra, Bertrand Farr, Mandalay, Buddy, Flamingo, Helen Wheeler* and *Salmon Rose*. In the raspberry class compare *Piquante* with *Highland Chieftain, Lady Franklin, Tarrytown, Ramona* and *Red Aroma*. In the purple class compare *Theron* with *Purple and Gold, Empress, Black Falcon, Black Prince, Purple Finch, Purple Elf, Black Sambo, Potentate, The Sultan, Northwestern Purple, Purple Waters* and *Purple Flash*. In the rose class compare *Fulva Rosalind* with *Petra, Dawn Play, Tara, Indian Chief, Wekiwa, Minnie, Mrs. Houston, Elizabeth Wheeler* and *Lady Franklin*. In the reds compare *Emperor Jones* with *Red Bird, Port, Matador, Red Hussar, Crimson, Mrs. B. Martin, General MacArthur, Fire Red, Sachem, Carnival, Peony Red, Vulcan, Neon, Vladimir Horowitz, Blood, Bold Commando, Warpath, Tejas, Spitfire, San Juan, Royalty, Victory Taierhehwang, Kanapaha, Ohred, Morocco Red, Warren Hutchings, Ruby Queen, Orlando, Tahiti Belle, Brackel, Wolof, Red Sox, Red King, Demon* and *Granada*. In the ruby class compare *Royal Ruby* with *Craemore Ruby, Ruby Supreme* and *Ruby T*. In bicolors compare *Chisca* with the pastel bicolors *Debutant, Cantabile, Sulin, Boutonniere, Peaches and Cream* and *Merriewoode Star* and with the strongly contrasting bicolors *Gay Troubadour, Bold Courtier, Royal Lady, Festival, Purple and Cream, Caballero, Bicolor, Mildred Orpet, Regal Lady, Betty Sleight, Tacoma, Bobolink* and *Jean*.

If I wished to attempt to improve upon my yellow and orange varieties I would compare those in the first and second groups with the following recent introductions, whose originators believe them superior or different from the flowers in Group I and II:

Early Bloomers

Yellow: *Earliana*

Orange Yellow: *Judge Orr*

Intermediate Bloomers

Light Yellow: *Little Cherub*

Orange: *Queen of Gonzales* and *Gloriana*

Bicolors:

Pastel: *Symphony*

Vividly contrasting: *Zoave*

Polychrome: *Dominion*

Eyed Varieties: *Aladdin*, *Buckeye* and *Gay Coquette*

Summer Bloomers

Cream: *Canari*, *Vespers*, *Moonbeam* and *Duchess of Windsor*

Light Yellow: *Mission Bells*, *Mrs. B. F. Bonner*, *Mongol* and *Gorgio*

Yellow: *Anna Betscher*, *Circe* and *So Big*

Orange: *Majestic*, *Joanna Hutchins*, *Gipsy Lass* and *Turbani*

Orange Yellow: *Annus Victoria Russell*

Polychrome: *Twinkle Eye*, *Painted Lady*, *Honey Redhead*, *Rajah*, *Dr. Stout*, *Dauntless*, *Melo*, *Afterglow* and *Chloe*

Late Bloomers: *August Prince* and *Boutonnierre*

The following are noted for their special characteristics as indicated:

Eyed Varieties: *Mikado*, *Rajah*, *Aladdin*, *Buckeye* and *Gay Coquette*

Curled and Twisted: *WauBun*, *Curly Pate*, *Taruga* and *Emily Hume*

Fragrance: *H. Flava*, *H. Citrina*, *Lemon Queen*, *Ophir*, *Princess*, *Soudan*, *Yellow Hummer* and *Patricia*

Bold Striking Contrast: *Mikado*, *Bagdad*, *Twinkle Eye*, *Gay Coquette* and *Rajah*

Small Sized Flowers: *Prima*, *Bijou*, *Boutonnierre*, *Multiflora*, *So Big*, *Little Imp*, *Summer Multiflora*, *Black Sambo*, *Saturn*, *Little Cherub*, *Yeldrin* and *Tom Thumb*

Large Sized Flowers: *Star of Gold*, *Hesperus*, *Indian Chief*, *Mongol*, *Golden Dream*, *Byng of Vimy*, *Hyperion*, *Ophir*, *Twinkle Eye*, *Annus Victoria Russell*, *Flavia*, *Mission Bells*, *Gorgio*, *Massasoit*, *George Yeld*, *Swan* and *Aristocrat*

Evening Bloomers: *Calypso*, *Gold Standard*, *Baroni*, *Citronella* and *Gold Imperial*

Extended Bloomers: *Orangeman*, *Estmere*, *Tangerine*, *Apricot*, *Gold Dust*, *Sovereign*, *Aureole*, *Winsome*, *Sirius*, *WauBun*, *Sir Michael Foster*, *Soudan*, *Radiant*, *Royal*, *Ophir*, *Mikado* and *Vesta*

Tall Plants: *Massasoit*, *Lady Fermoy Hesketh* and *Nebraska*

Short Plants: *Pigmy*, *Minor*, *Gracilis* and *Nana*

Semi-Dwarf: *Tangerine*, *Estmere*, *Orangeman*, *Gold Dust*, *Apricot* and *Sovereign* (all intermediate bloomers)

Double-Flowered: *Kwanso*, *Flora Pleno* and *H. Fulva Variegata*

A selection of the named varieties of daylilies which I like best, irrespective of price, in some color classes is simple but in others it is most difficult. Here is my selection

Early Bloomers:

Yellow: *Earliana* or *Elizabeth*

Orange: *Judge Orr*

Intermediate Bloomers

Cream Yellow: *Winsome*

Light Yellow: *Little Cherub* (This is my seedling so I am definitely prejudiced, but I like it very much)

Orange: *Queen of Gonzales*

Red: *Wekiwa*

Bicolor—

Pastel: *Symphony*

Strongly Contrasting: *Zoave*

Polychrome: *Dominion*

Eyed Variety: *Gay Coquette* (again a seedling of mine)

Summer Bloomers

Cream: *Vespers*

Light Yellow: Either *Hesperus*, *Mission Bells* or *Mrs. B. F. Bonner* (I cannot decide at this time)

Yellow: *Anna Betcher*

Orange: *Majestic*

Orange Yellow: *Golden West*

Pink: *Sweetbriar*

Raspberry: *Piquante*

Purple: *Potentate*

Rose: *Dawn Play*

Red: *General MacArthur*, *Red Sox* or *Tejas*

Maroon: *Morocco Red* or *Wolf*

Bicolor—

Pastel: *Debutante*

Contrasting: *Bold Courtier*

Polychrome: *Painted Lady*, *Twinkle Eye*, *Honey Redhead* and *Dr. Stout* (all different and very good in my garden)

Eyed Varieties: *Mikado*

Late Bloomer: *August Prince*

However, I have seen many as yet unnamed seedlings which I am sure will replace some of the above named varieties in time.

DAYLILIES AS A HOBBY

GEORGE GILMER, *Virginia*

Daylilies are my hobby. A relative gave me two varieties some years ago. I have added 78 kinds to my collection since. I have only discarded two but will let others go as I get newer and better ones.

I get a few new ones by purchase or exchange nearly every year. During blooming season my son and I hurry out every morning before breakfast trying to be first to find a bloom on a new variety. In two years the plants are usually large enough to divide. I often want several dozen plants of a fine kind. This means a second division after another two years.

I like daylilies because they are almost free from insects or disease. I have had brown spots on the foliage of one variety. They need no spraying, dusting or winter protection.

When I plant them I water them and put a mulch of leaves, weeds, grass, corn shucks, pea hulls or other vegetation around them. I *never* work around or between them! Mine generally produce as large and numerous blooms as the catalogue descriptions. They are as vigorous as any I have seen at a commercial growers or at the United States Experiment Station, Beltsville, Maryland. My roots are larger than any I have bought. I have practiced on my daylilies for years the method of cultivation recommended in "Plowman's Folly," except that there has been no discing. If weeds or grass try to choke the daylilies while young, they are pulled up, dirt knocked off the roots and added to the mulch. After daylilies are well established they form such a dense compact mass that a weed seldom appears among them. I plant daylilies all around my place, under trees and among the shrubs. They succeed where they have full sunlight one-fourth the time. I plant my newer and better ones where they have sunlight one-half the time or more. As far as I can tell they grow just as well with full sunlight half the time as they do with more light.

The season of bloom here is from May to the middle of November. They can be moved at any time. My losses have been less than one plant in a hundred. Frequently I move them during blooming season to be sure of the variety. The first plants I received came in July. I hurriedly set out some sixty plants of two kinds one evening after work. A dry spell followed when water was so scarce we were not allowed to water any plants. All the foliage died to the ground in August and I thought the plants were dead. A rain came in September. Up they came like springtime and I had good October blooms from plants that normally bloom in May. Ever since I have been a daylily fan.

Trading with growers is a lot of fun. Plants multiply so in a few years you can share them with friends. Twice the Farr Nursery has given me some of their newest introductions for my surplus stock of plants they had previously sold me.

I love to watch the difference in growth. Some start much earlier than others in the spring. Some, like *Chengtzu* are very drought resistant. Some form only compact clumps. Others send out underground

roots and throw up shoots a considerable distance from the parent plant. The foliage of some die in the fall while others are blooming. Some have good green foliage after heavy frost. *Linda*, *Vulcan* and "Summer Multiflora Hybrids" have plant buds on the flower stems. They start roots about when the last flowers on the stem have bloomed. Planted in the open ground with the bud an inch deep and a few leaves above ground, 75% will develop into plants. They are always the true parent stock. I believe you can raise 100% with care that bloom the second year.

Daylilies are a relatively inexpensive hobby with lots to interest the grower during most of the year. I find seedlings interesting. It is fun to try to figure from parentage plants, blooms, stalk, etc., what the blooms will be before they open. The chance of getting a worth while plant is less than one in a thousand, but it is fun and there are people glad to get seedlings. They can be used on roadsides and along streams and open woods. No wonder they are the favorite flower of an increasing number of enthusiasts.

FEEDING DAYLILIES

J. S. COOLEY, *Maryland*

Good gardeners have learned by experience that if they expect to get an abundance of fine flowers from such plants as the peony, the narcissus or the chrysanthemum that a mellow and fertile soil must be provided and that even better results are obtained if the soil is prepared and enriched the year before planting. For the daylily, however, the idea often prevails that all one has to do is to plant them, that they grow in any climate, in any kind of soil, in full sun or in full shade. It is true that *Fulva* and some other kinds will stay alive and even bloom under very adverse conditions. But most varieties will respond just as much to a deep fertile mellow soil and to good culture as any other garden flower. That naturally raises the question, what is good treatment? Some varieties will respond better than others to good treatment or conversely some varieties will take adverse soil and moisture conditions better than others, but in general a deep friable soil well stocked with humus is desirable. It is also important that daylilies be planted far enough away from trees and shrubs so they will not be robbed of moisture and fertility by the adjacent trees or shrubs. An application of a tablespoon full to the square foot of such mineral fertilizer as a 5-8-5 has given good results with the writer. A word of caution, however, should be given, for although the daylily is a vigorous feeder it is very easy to overdo the application of commercial fertilizer at the rate of 600 lbs. to the acre is usually sufficient. A compost pile where leaves, dead plants and even brush are rotted is just as necessary for the grower of daylilies as for the grower of other garden flowers. A liberal application of such compost worked into the soil at planting time will always repay the effort. The response of daylilies to a deep fertile soil may be observed if one sets a plant in soil that has been dug and enriched to a

depth of 16 or 18 inches. After a year or more if the clump is taken up he will note the mass of deep roots and realize that the daylily is a vigorous feeder when one provides the food and the feeding space.

It may be inferred that since daylilies thrive in a fertile soil that the application of fresh manure would be beneficial, but such is not the case just as with many other plants. In the experience of the writer there is some constituent in fresh manure especially in such concentrated manure as chicken manure that is toxic to daylilies. Soon after the application of fresh manure growth stops and the leaves begin to turn yellow. Cases have been reported where there was good evidence to show that daylily plants have actually died from the application of fresh manure.

WHAT CAUSES RICHNESS OF COLOR IN DAYLILIES?

J. S. COOLEY, *Maryland*

The summer of 1943 was unusually dry with few cloudy days. It was common observation of daylily growers here in the vicinity of Washington, D. C. that the colors of daylilies were decidedly disappointing. During these bright and warm days with little humidity the flowers of such varieties as *Pale Moon*, *Anna Betscher*, *Sunny West*, *La Tulipe*, and *Vulcan* faded or burned considerably while other varieties such as *Rajah* that do not burn even on a hot day did not burn but they did not seem to have the sprightly character that one expected judging from remembrance of the color in other years. One of our seedlings that seemed to be such a strikingly brilliant red in 1942 seemed to be less bright in the summer of 1943, apparently because of an excessive amount of an under color of yellow making for dullness. In the summer of 1943 a situation occurred that very materially affected the color of daylilies. When the mid-season varieties were in the height of their blooming season there was a local rain of nearly an inch followed by moderate temperature—not especially cool. The flowers the next day after the light rain and the weather conditions mentioned above were particularly beautiful. Such varieties as *Dr. Stout* that is always beautiful *was especially charming for the gold that seems to be dusted over the flower now had a glistening reddish sheen that was gorgeous*. *Rajah* was very much brighter than usual. In fact those varieties usually having a copper tone on this particular occasion had a pleasing reddish under tone.

One might very properly ask the question, what makes rich tones and bright colors in daylilies? Are daylily flowers different from other flowers with respect to the causes of bright colors? Bright colors are usually associated with cool weather. As one drives from the lower elevations to the higher in the Cascade Mountains and observes the color in the bracts of Indian paint brushes (*Castilija*) growing by the road side, it is very obvious that the red tones get richer as one advances to the greater elevation. This change in color from a yellow to a flame color as greater elevation is attained is usually considered due to temperature. Where flower color is concerned there is probably a different situation

than obtained in the bracts and leaves. With *Narcissus* which is also an amaryllid, it is a common belief that such varieties as *Fortune*, *Fire Tail*, *Mrs. Brewster*, and others, when growing here in the vicinity of Washington, D. C., have much more red in the cups and are much richer color in those years when the weather is cool at blooming time than on those years when the weather is hot. Dryness is seldom considered a limiting factor in the early spring when *Narcissus* are blooming. It would be interesting if one were to grow certain varieties of daylilies in different moisture and temperature conditions with other factors the same and thus determine to what extent these things influence quality of color. It may be that the available supply of certain mineral nutrients has its effect on color. Or it may be due to such an interaction of the temperature, moisture and nutrition factors so that one cannot separate out any one element and say this is the responsible agent. At any rate it would be interesting if the readers of this publication would record their experience and observations of the things that make for richness of color in daylilies.

HYBRID AMARYLLIS CULTURE AT MIAMI, FLORIDA

Miami, Florida,
September 16, 1944.

Dear Members:—

It gives me a great deal of pleasure to read the many good articles in HERBERTIA, particularly those on types, cultivation, hybridization and propagation of hybrid *Amaryllis*.

I am an amateur grower of hybrid *Amaryllis*, Mead strain, and it might be of interest to other growers to give an account of some of the experiences I have had, which I have not seen mentioned by any other *Amaryllis* growers. Here in the region of Miami, Florida, I started about 10 years ago with a small number of Mead Strain Hybrid *Amaryllis* bulbs as a hobby, and through vegetative propagation and seedlings the increase has been tremendous.

Field culture in this semi-tropical climate, where the sun shines almost constantly although the thermometer does not rise so very high, calls for partial shading of hybrid *Amaryllis*. This shade has been supplied in my garden largely by Avocado trees, erroneously called "Alligator pear." It is hardly necessary to add that all who visit here are delighted with the delicious Avocado fruits as grown in the Miami region.

Additional shade is supplied by the bi-annual planting of the *Carica papaya* trees which produce most delicious and delightful fruits of this region or any other region. The fruit when eaten fresh has a gentle laxative effect and is served as an excellent dessert. Some of these Papaya trees give leaf shade from eight to twelve feet and produce fruit at the rate of from 25 to 300 pounds per tree. We plant the Papaya trees about 12 feet apart.

In addition to the above, we plant an extra cover crop to protect the soil from the penetrating rays of the sun with a vining pea, called Nassau Red, which literally covers the entire area from six to eighteen inches deep, providing ample shade for the soil and bulbs during the summer season. In the fall the hybrid *Amaryllis* are not in very active growth after growing about ten months in the year. It may be well to state, that when nature does not furnish sufficient moisture that we rely on over-head irrigation to supply the necessary moisture for my garden. In general it may be truthfully said that my garden in the Miami area is a very busy portion of nature's playground of activity, including Avocado trees, Papaya trees, Pea vines and the many thousands of *Amaryllis* bulbs; and were it not for the wonderful sunlight above referred to, nature could not exert herself in such a wonderful degree of activity and productivity.

One of my main reasons for the writing of this letter is to state, that in the commercial cut flower market in the Miami area the demand for this most beautiful Lily by the buying public shows that the appreciation of this gorgeous flower is an established fact. We have for the past twelve months been supplying *Amaryllis* blooms as cut flowers through the trade in this city even in the months of July, August and September, and have this date sent several dozen to the flower market, when customers can hardly believe that *Amaryllis* blooms are available at this season of the year.

It is my opinion that the *Amaryllis* will become one of the standard cut flowers on the market due to its keeping qualities from its bud stage to its decline. When kept in vases with the water changed daily, it will retain its brightness and beauty from three to seven days. I believe the growers of *Amaryllis* would do well to encourage the introduction and marketing of these beautiful lilies of nature.

Of course experienced growers of *Amaryllis* know that the blooming period varies in different climates. Here in Miami, our volume of bloom is between February 15th and April 15th. During this time when the blooms are out in full glory by the many thousands in my garden, the varying shades of miscellaneous colors, patterns appear to the eye of the lover of nature in a manner that no words can express—the wonder, beauty and glory of nature in flowers. It is truly “A wonderful sight to behold.”

Through the publication of *HERBERTIA* we have and are receiving many nice orders for our bulbs from all parts of the United States.

I sincerely trust that all the *Amaryllis* growers get as much kick and pleasure out of their activity with these beautiful lilies as I do out of mine as a hobby and diversion from the active practice of Medicine and Surgery.

Yours very truly,

J. G. Du Puis, M.D.

AMARYLLIS PSITTACINA

W. M. JAMES, *California*

This flower should be seen in color to gain a true impression of it. The green and red color in the petals reflect so near the same light value that the difference in color does not show well in a "black and white" (Figure 134).



Figure 134. *Amaryllis psittacina*. Photo by W. M. James

The flowers were about five inches across and about six inches long. The scape was eighteen inches high. The segments are slightly wavy, crimson on the edge and with the keel and most of the lower part a bright vivid green. There is no distinct separation between the red and green. Many colored lines radiate from the green into the red. The stamens are shorter than the perianth. The flower was on a bulb received from the United States Department of Agriculture several years ago. It would be interesting to know whether this green color is produced by anthoxanthin or chlorophyll. The color is very different from the green color of the vegetative parts.

AMARYLLIS IN WEST TEXAS

IRENE STEWART, *Texas*

It is possible, my love for flowers, and especially bulbous plants, started from babyhood. At the country place where I was born in Louisiana, there was a brick walk from the front "gallery" steps to entrance gate. On either side of walk, there was first a border of violets, then blue and pink Roman hyacinths and lastly red *Amaryllis Johnsonii*.

By the back "stoop," which was wreathed in Madeira vines, was a clump of what we called "crow's foot" lilies (*Hymenocallis*) and scattered about the landscaping were groups of "Milk and Wine Lilies" or crinums.

The beauty and fragrance of these plants lingered in my mind and senses as later the family moved about—finally landing at El Paso, on the extreme Western Border of Texas, where growing any sort of flower, was then thought a miracle.

Mother and I longed for verdure and the lush growth to which we had been accustomed, so the quest began for things which would transform our desert home, survive the heat and drouth of summer and the winds and frosts of winter, at which time the temperature sometimes dropped to 10° F.

The ventures were mostly costly and disappointing until the rocks were mined from our mesa garden, far above the City proper, and the soil built up with good valley dirt, sand, barn-yard fertilizer and all the humus we could accumulate from a compost heap. It certainly was a process of evolution and survival of the fittest.

When the shrubs and trees began to give shade, there was more reward with bulbs, as not many can stand the constant baking to which they are submitted and the drying, battering thrusts of the wind.

My mother has passed on but I have continued with the garden and therein found comfort and solace with my flowers including various bulbs. Each year a few new specimens are added.

One time an *Agapanthus africanus* var. *Mooreanus minor* was bought and at another *A. orientalis* (*unbellatus*)—both lived several years without increasing in size, multiplying or blooming and finally each failed to put in an appearance at all.

Amarcrinum Howardii grew for at least five years and multiplied before showing a bloom. There are now five bulbs from the original; all thrifty, fine plants but they fail to bloom but the one time per season, usually in late August.

Brunsvigia rosea is nipped back by the freezes each winter and this seems to prevent blooming, although the bulbs are fine and large.

Crinums are found to be especially satisfactory and are both admirable for their flowers and tropical appearance. To do well in this section, they need a copious amount of water during the growing season. The only one bought, which has failed to respond, has been *Crinum bulbispermum* var. *alba* but it was in a rather dry, shrivelled condition when received from the dealer and although it lived for two years it never

grew—was moved twice hoping that a new location might help. There are three types of “Milk and Wine Lilies” but they were not identified when acquired. Two of these bloom during the summer but not at the same time, and then repeat when the first bloom scape has fallen. The third is late fall flowering, very fragrant but recently has become quite erratic in its blooming habits, probably due to the fact it hasn’t been moved in some years and has become too crowded, however it looks thrifty and fine. There is another unidentified *Crinum*, probably *C. bulbispermum* var. *rosea*, which I dug from the yard of an old house which was being dismantled. It is hardy but the flowers are small, of light pink color and usually fade with the coming of dawn.

C. Ellen Bousanquet is most gratifying, both as to bloom and the setting of off-shoots. *C. Cecil Houdyshel* is lovely but foliage is so long and trailing that the stiff winds tend to twist and damage the plants, which do not stand erect as do the other specimens in the garden. The original bulb has multiplied to three and at this writing, in late July, all are blooming, making a pleasing sight. With me, these bulbs do not bloom throughout the year as in California. My first crinum seedling, now a year old, from *C. Cecil Houdyshel* is doing well. Even though I have tried making crosses only a very few seed are ever set on any of my plants and usually those produced are not from crosses but are naturals. The dry atmosphere seems to dehydrate the pollen too quickly. *C. Moorei* has been in my possession for two years but has not flowered yet. *C. Powellii alba* is one of my favorites, and its behavior, in every way, is beyond reproach. *C. White Queen* is another which should receive an award of merit for it is both beautiful and hardy, although its lovely curving, snowy petals do not withstand the bright sunshine as well as *C. Powellii alba*. My city lot has now become so crowded, I am afraid I shall not be able to further increase my crinum collection until a suitable new location is found.

Hemerocallis haven’t been much of a success, especially the hybrid ones. *H. fulva* and *H. Kwanso* are the most satisfactory but even they can not stand the full rays of the blistering sun without the foliage burning.

Amaryllis have been a joy and I have exhibited and received prizes at several local flower shows. Bulbs have been bought mostly from the best Western hybridizers. Use enriched soil and plant in about 50% shade. Before Mr. Diener’s death I obtained a few of his *Equestris* and “everblooming mammoth flowering” hybrids. The former are most robust, but the latter larger and more exquisite as to color and shape, although some plants have a tendency to multiply too rapidly, produce rather spineless foliage and bloom very little. I have never had any of these bulbs to bloom more than once per season, however at times, some produce flowers later than average. From a pure white Dutch hybrid, I have made some crosses and have some nice bulbs but as yet they have not blossomed. It seems to take more than two or three years here for a bulb to reach full maturity. Have had no trouble getting seed to germinate from crosses made but as I have no greenhouse and plant exclusively

in open ground, only the hardiest survive, and possibly these will not be the finest. Was truly pleased with *Amaryllis ambigua* which I secured from Mr. Houdyshel this spring. It rewarded me with two healthy scapes but I was not successful in making any crosses on other stock. Did not try on *A. ambigua* itself considering that it was not sufficiently established. *A. Johnsonii* hasn't responded as well as the others but possibly it would do better with less shade and pampering. I tried out a McCann's double amaryllis—it lived several years but did not increase in growth, nor did it bloom—finally rotted. *A. advena* or Ox-blood Lily has been highly successful in every respect.

An acquaintance has a number of small salmon-pink amaryllis, not identified, which bloom at the same time as *A. Johnsonii* and although it does beautifully for her, the small bulb which I was able to secure does not seem to make much headway in growing. This spring I sent for what was said to be an "*Orange Amaryllis*," advertised by a private party, but as bulb was small and has not yet bloomed I have been unable to find out what it is.

Hymenocallis calathina has been growing in my garden for about ten years and has now made a large clump, seems hardy in every way but has never bloomed, although, for a time, I transplanted it regularly. Several weeks ago I saw one of these Peruvian Daffodils blooming in a neighbor's yard. I was quite thrilled as I had never seen its flower before. Her plants have broader and more robust looking foliage, large white flowers with green markings. She acquired her bulbs from a friend last fall. I have never bought any of the hybrids as they have been quite expensive and I was afraid my experience with *H. calathina* might be repeated. Have two large groups of *Hymenocallis* species No. 2, one of which is in bloom at the present time—very satisfactory.

Have had only fair success with three species of *Lycoris*, namely *L. aurea*, *L. radiata* and *L. squamigera*. The latter is in flower now but they all seem to require a two year rest period after blooming. Have bought other species and also Nerines but they have failed to respond to the treatment I have been able to give them.

Sprekelia formosissima superba bloomed the first year after planting and although it is a robust grower and has multiplied wonderfully has never repeated the performance.

Tulbagia violacea, now in flower, has proven a valuable addition to my collection, however it has one specific season of bloom here.

Vallota purpurea has been tried out twice but both bulbs rotted. *Zephyranthes* are good subjects and very hardy in this climate. There is a small yellow "rain lily" which thrusts itself up through the hard soil and rocks on vacant lots around me and is most lovely but when transplanted to my garden refuses to exist.

I have the very best results with *Narcissus*—various species of tazetta and poetaz—but not much luck with trumpet daffodils. The latter may or may not come up after bulbs are planted, may bloom once and after dying never appear again. The double "Twink" has proven the exception however, for it is gratifying in every way.



Hybrid Brunsvigieae: right top, Crinum Cecil Houdyshel; left top, Crinum Ellen Bosanquet; left bottom, Brunsvigia Frank Leach; and right bottom, Brunscrinum Corsii. Photo by Perry Coppens.

There have been many species of smaller bulbs, such as *Chlidanthus fragrans*, which have come and gone, however there is one little bulb I will tell about which has proven itself more or less of a nuisance. It is the most prolific thing I have ever seen and really is very pretty in a border. This one is *Brodiaea uniflora* or whatever one wishes to call it—there are so many names under which it is listed one becomes bewildered. When I start that long dreamed of new garden I am afraid I shall leave this little fellow out in the cold. Now isn't that human nature?

HYBRID BRUNSVIGIEAE

L. S. HANNIBAL, *California*

We are indebted to Mr. Perry Coppens for Plate 277 showing several hybrid Brunsvigaeae. *Crinum Cecil Houdyshel* is well known to many for it is a hardy hybrid that is very free-flowering. Usually the plant requires some shade to keep the bloom from burning, but this is typical of all hybrids having *Crinum Moorei* percentage.

Crinum Ellen Bosanquet in some respects resembles the crinum above, but its color is a deep wine. The parentage of this plant has never definitely been established, but *Crinum Moorei* characteristics are quite evident. It too needs some shade to get the best flowers.

Brunscrinum Corsii is nearly identical with Mr. Howard's hybrid, known as the "Amarcrinum." This is a cross of *Crinum Moorei* on *Brunsvigia rosea* (syn. *Amaryllis belladonna* Ait. et Herb., non Linn.). We don't believe that there is a prettier sight than a clump of these plants in flower. The blossoms resemble the Cape Belladonna seed parent, but the *Crinum* foliage adds a much needed touch of green that accentuates the richness of the soft apple blossom pink.

Brunsvigia Frank Leach was introduced last year. Excluding some of the white *multiflora* hybrids it represents one of the better Cape Belladonnas so far developed, or should we say discovered, since it was a chance seedling found in an old California garden. The blossoms open nearly white, but turn to a beautiful warm pink as the flowers age. The ruffled texture of the segments place it apart from the usual class of hybrids now being produced.

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Note.—Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practicable each trial garden will publish, in *Herbertia*, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

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Volume 1 (1934). DEDICATED TO HENRY NEHRLING. Containing the biography of Henry Nehrling, and many valuable articles on amaryllids; with a portrait of Henry Nehrling and 16 other illustrations; a total of 101 pages.

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Volume 10 (1943). 10TH ANNIVERSARY EDITION. Dedicated to Elizabeth Lawrence, the outstanding authority on the use of amaryllids in the garden, who contributes a summary of her work in this field. This volume contains the review of *Agapanthus* and *Tulbaghia*, by Dr. Uphof; an article on *Brunsvigia rosea* and hybrids by Mr. Hannibal; a symposium on *Narcissus* breeding by Messrs. Powell, Reinelt, Berry, and Reynolds; a review of amaryllid chromosomes by Dr. Flory; articles on hybrid amaryllis, daylilies, and many other important articles on amaryllids. Forty-one illustrations—12 plates and 29 text figures—and a total of 205 pages.

Volume 11 (1944). ALLIEAE EDITION. Dedicated to Dr. Henry A. Jones, the eminent American authority on the onion. This is one of the most outstanding issues up to the present for its record making contributions on the systematics of *Allium* by British authorities, and on onion breeding, propagation, and culture by American authorities. It contains Mr. Airy Shaw's translation of Vvedensky's *Alliums* of the Soviet Union; Stearn's essay on the onion in the Old World and other articles; and articles on onion breeding, propagation and culture by Dr. Jones and his colleagues. There are also important contributions on ornamental *Alliums* for North America, and *Allieae* of North America. There are excellent articles on hybrid *Amaryllis*, *Narcissus*, Daylilies and various

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It is recorded that the Garden of Eden was the first garden to be planted with all the plants necessary for Man's sustenance in comfort and luxury. A life of ease soon grew irksome to him and in a moment of idleness he ate of the forbidden fruit. For this disobedience he and his descendants were denied the fruits of the garden and were cast out to earn their daily bread by the sweat of their brow.

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The passing of the centuries brought increased population. The quarrels grew into battles and wars. Gradually as their wanderings were hampered and restricted, it became necessary to confine their herds to smaller areas and to bring the fodder to them instead of allowing them to wander in search of it. Thus, they came in less conflict with their closer and closer approaching neighbors, and soon isolated communities became villages seeking mutual benefits and organized resistance against their common enemies. Communal life brought them into closer contact with each other and soon competition was keen and spirited for a greater share of the worldly goods.

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1945

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Address correspondence and send membership dues to:

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The American Plant Life Society

Box 2398, Stanford University P. O., California

HERBERTIA

VOLUME 12

EDUCATIONAL EDITION

EDITED BY
HAMILTON P. TRAUB

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford University P. O., Calif.

1945

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The American Plant Life Society,

Box 2398, Stanford University P. O., Calif.

PREFACE

The 1945 issue of *HERBERTIA* is dedicated to Supt. R. H. Huey, an outstanding American educator, who has had the imagination to see that the amaryllids offer one of the most excellent tools for the teaching of plant science in our public schools. In recognition of his outstanding contributions in this field, the WILLIAM HERBERT MEDAL for 1945 has been awarded to Supt. Huey. His pioneer work is being generally recognized, and his example is being followed in other parts of the country. Supt. Huey contributes to this issue of *HERBERTIA* a brief autobiography, an article on the use of amaryllids as an educational tool, and a brief history of the Paintsville, Kentucky, Public Schools.

The beautiful cover design, featuring *Brunsvigia rosea* (syn. *Calli-core rosea* Link; *Amaryllis belladonna* Ait.) is the work of J. Marion Shull.

After the 1940 to 1945 Nazi blackout of the Netherlands, we are pleased to report that Ida Luyten (Mrs. Ida Olivier-Luyten) has been able to favor the members with two outstanding articles on the culture and optimum flowering of hybrid *Amaryllis*.

The articles on daylilies include preliminary reports from some of the regional trial gardens, a second announcement of the daylily check list, registration of daylily clones, articles on doubleness in daylilies by Dr. Stout, daylily breeding by Mr. and Mrs. Eugene A. Taylor, and J. Marion Shull, favorite daylilies by George Gilmer, daylilies in the Adirondacks by Prof. Stanley E. Saxton, daylily tests by Elizabeth Lawrence, daylily leaf spot disease, and methods of packing and shipping daylilies by Dr. Cooley.

Dr. Fernandes and his wife contribute an important article on the origin of *Tapeinanthus humilis*, a near relative of *Narcissus*. Other *Narcissus* articles are contributed by Frank Reinelt on new daffodils, the late C. E. Bailey on pink daffodils, and Mrs. Benners on experiences with daffodils.

Dr. Uphof favors us with an article on *Leucocoryne* and related South American genera. W. T. Stearn contributes a revision of Sir Joseph Hooker's *Alliums* of British India.

Mulford B. Foster, the eminent plant explorer, writes on the re-introduction of *Alstroemeria caryophyllaea*, and Harry L. Stinson reports on the true *Alstroemeria Ligtu* which was re-introduced by Prof. Goodspeed of the University of California.

There are articles on *Amaryllis reticulata*, on amaryllid culture, and other valuable contributions but space limitations prevent mentioning them all in this brief preface.

At the beginning of the post-war period, it seems worth while to consider briefly the past issues of *HERBERTIA*, and the plans for the future. During the first decade of *HERBERTIA*, the following editions were brought out—

- Vol. 1 (1934) Henry H. Nehrling Edition
- 2 (1935) Theodore L. Mead Edition
- 3 (1936) First British Edition—dedicated to Arthington Worsley

- 4 (1937) Second British Edition—dedicated to William Herbert
- 5 (1938) Netherlands Edition—dedicated to E. H. Krelage
- 6 (1939) First South African Edition—dedicated to Dr. E. E. Galpin
- 7 (1940) First Latin American Edition—dedicated to Amaryllid pioneers
- 8 (1941) First Daylily Edition—dedicated to the daylily pioneers
- 9 (1942) First Alstroemeria Edition—dedicated to Harry L. Stinson
- 10 (1943) 10th Anniversary Edition—dedicated to Elizabeth Lawrence

The beginning of the second decade of HERBERTIA coincided with the maximum American war effort in 1944. Most of the linotype operators at our printer's establishment were taken into the armed forces, and it was not possible to bring out Vol. 11 (1944) on time, and it was not published until early in 1946. We wish to thank the members for their kind consideration, understanding and patience under these conditions. Now that the war is over, the publication schedule will be brought up-to-date as soon as possible. Vol. 12 (1945) is the present issue; Vol. 13 (1946) Narcissus Edition, and Vol. 14 (1947) Daylily Edition, are scheduled for publication in 1947, and thereafter, HERBERTIA is scheduled for publication regularly toward the end of each year (October). The second decade of HERBERTIA, including the two published volumes, and the volumes tentatively planned for the future, are indicated below—

- Vol. 11 (1944) Allieae Edition—dedicated to Dr. Henry A. Jones (publ. in 1946)
- 12 (1945) Educational Edition—dedicated to Supt. R. H. Huey (publ. in 1947)
- 13 (1946) First Narcissus Edition—dedicated to Guy L. Wilson
- 14 (1947) Second Daylily Edition
- 15 (1948) Second South African Edition
- 16 (1949) First Australasian Edition
- 17 (1950) Second Latin American Edition
- 18 (1951) Second Narcissus Edition
- 19 (1952) Third Daylily Edition
- 20 (1953) Third British Edition

Contributors to any of the volumes from 13 to 20, inclusive, should send in their articles as soon as possible after their completion so as to facilitate the planning and publication of these issues.

The details for Volume 13 (1946), NARCISSUS EDITION, are well advanced due in great measure to the wholehearted cooperation of Arno H. Bowers of the Narcissus Committee. Dr. Fernandes and wife have already sent in their article on chromosomes of the Subgenus *Ajax*, Genus *Narcissus*. Other articles on *Narcissus* have also been received, and the

[PREFACE, continued on page 7.]

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[PREFACE, continued from page 4.]

remainder are expected to arrive in the near future. The other amaryllids will not be neglected in this issue since important contributions on daylilies, *Amaryllis*, *Alstroemeria*, etc., will also be included.

Beltsville, Maryland,
September 6, 1946

Hamilton P. Traub
Editor

NOTE FOR HERBERTIA AND PLANT LIFE CONTRIBUTORS

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves*, *scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

ERRATA

HERBERTIA, Vol. 11 (1944)

Page 3, line 18 from bottom, for "Stream" read "Stearn."

Page 8, line 18 from top, after "INTERSPECIFIC" add "STERILITY."

Page 21, between sections ANGUINUM and ALLIOTYPUS, in a separate paragraph insert "PETROPRASON F. Hermann (1939); syn., genus *Camarilla* Salisb. (1866); type-species, *A. obliquum* (Bot. Mag. t. 1508)."

Page 261, top line, and line 17 from top, for "Koidyumi" read "Koidzumi."

Page 266, line 18 from top, for "*Triple Trest*" read "*Triple Treat*."

Page 319, line 14 from bottom, for "pistils" read "pistil."

line 10 from bottom, for "hardly" read "hardy."

line 9 from bottom, delete "and westward in Asia Minor."

lines 27-28 from top, for "*album-santi*" read "*album Santi*."

Page 356, line 29 from bottom, for "Percy Lancaster" read "Percy-Lancaster";

line 11 from bottom, for "Syney" read "Sydney."

[ERRATA, continued on page 167.]

[REGIONAL DAYLILY TRIALS, continued from page 36.]

5. DEPT. OF FLORICULTURE & ORNAMENTAL HORTICULTURE,
CORNELL UNIVERSITY, ITHACA, N. Y.

Dr. L. H. MacDaniels writes that notes have been taken on the daylilies in the collection and a report will be made in a future issue of *Herbertia*.

6. DIVISION OF HORTICULTURE, TEXAS AGRICULTURAL
EXPERIMENT STATION, COLLEGE STATION, TEXAS

Dr. S. H. Yarnell writes that rather detailed notes have been taken on the daylilies in the collection, and a report will be made in 1946 *Herbertia*.

DAYLILY CHECK-LIST — SECOND ANNOUNCEMENT

Prof. J. B. S. Norton, 4922 40th Place, Hyattsville, Maryland, reports further progress toward the completion of the comprehensive daylily check-list. According to present plans, it will be included in Vol. 14 (1947) of *Herbertia*, the Second Daylily Edition.

For a statement requesting the cooperation of all interested in the daylily so as to make the check-list complete, the reader is referred to page 253, Vol. 11 (1944) of *Herbertia*.

POSTSCRIPT.—Since the above was written, Mr. M. Frederick Stuntz, Williamsville 21, N. Y., has agreed to assist Prof. Norton with the completion of the Daylily Check-list that is sponsored by the Society, and will be published as soon as ready in 1947.—*Editor* (1-16-47).

POSTSCRIPT.—The members will be interested to hear that the Midwest Hemerocallis Society was organized in 1946. The Secretary is Daisy L. Ferrick, 416 Arter Ave., Topeka, Kansas.—*Editor* (1-16-47).

Dedicated to
ROBERT GARNETT HUEY,
the pioneer,
in the use of amaryllids
as an educational tool.



Herbert Medalist—Robert Garnett Huey

ROBERT GARNETT HUEY

An autobiography

Two scenes stand out among the many of my boyhood memories. One is of my father as he stood with tears in his eyes looking across row after row of shocked corn in a field already green with autumn seeded wheat and mellow with the light of the setting sun and of his words as he placed his hand on my shoulder and said, "Son, sometimes the fields are so beautiful that I feel like weeping." The other is of my mother, at the close of a long day of household work, sitting with a pencil and sheet of paper in front of a clump of hollyhocks as she sketched a spike of the flowers in infinite detail.

To this father, who taught his sons that the land was owned as a trust to be farmed in such a manner as to be continually improved and made better, who took time to teach us the trees and the plants and the infinite wealth of Nature in field and woodland, and to the mother, who brightened the home and the yard with flowers, is due, perhaps, my early and lasting interest in plant life.

My birth place was a farm home on the bank of the Ohio River in Northern Kentucky, where my ancestors from Virginia had settled in the late part of the 18th Century. The date was December 16, 1889 and I was the second son.

From the front yard of that home came my first acquaintance with amaryllids,—great naturalized patches of old fashioned "snow drops" lifting their dainty blossoms along with purple violets from the blue-grass turf. In the background clumps of narcissus and jonquils mingled their white and yellow hues. Here, I grew and played and worked. Flowers and plants, trees and shrubs, birds and small wild life were the background of my environment.

In time there were flowers of my own, a corner of the garden where I might plant and dig and experiment with the seeds and bulbs and cuttings secured from neighbors, and later, from nurseries. During one of those boyhood periods a seedling apple tree in one of the pastures bore seventeen different varieties as a result of my amateur attempts in grafting.

My elementary education was secured in the rural school. Following it came four years in the only high school in that county. A year of teaching in the two room school at the county seat provided funds to attend Georgetown College, at Georgetown, Kentucky. Upon my graduation in 1913, teaching had been selected as a profession and my first work was in Bacone College, Oklahoma, a school for Indians. Later, came a superintendency in Kentucky.

At the age of 26 I married Hallie Cheap, the daughter of a Methodist minister. We have three daughters. One is married, her husband in the Navy; another is a nurse in the Army Air Force; the youngest a student at Miami University.

The intervening years have been spent in three superintendencies. A Master's Degree from Peabody College was earned and further grad-

uate work done at Johns Hopkins and the University of Chicago. Several summer terms have been spent in teaching at Morehead State Teachers College, Murray State Teachers College, and Pikeville College.

During that first superintendency I became acutely aware of the lack of beauty and its appreciation in the homes and lives of so many of our students. There were eyes that did not respond to the skies and the flowers, lives that were colorless, souls that were barren, and homes that were ugly and unattractive. Could the school teach them to see, could it make them feel, could it bring them appreciation? For thirty years I have tried to answer that question. And, surely, it is a legitimate quest. Experience and observation have brought me the firm conviction that the child who has not had developed in him a recognition of the beautiful and an appreciation for the best has not been fully educated. To go through life without the capacity to enjoy the bounty of Nature's panorama, to not be able to see the beauty of a perfect blossom, to not feel the fascination that comes from patiently caring for a rare plant is to miss the satisfaction, the contentment, the peace, and the uplift of soul that can come only from the recognition that it is a part of the handiwork of the Infinite.

Hybridizing early became one of my interests. Twenty years ago I began to breed dahlias. From South Africa, from Australia, from India and Japan, from the British Isles, from Continental Europe, from Alaska, I collected the best available and in a school garden grew and tested and crossed them with the aid of my students. Comparative studies were made of the characteristics, the habits and the growth of seedlings from different lands and crosses. Today, in those two communities hundreds of homes grow dahlias, the best of dahlias, through the interest of those school boys and girls. One of those seedlings was last year placed upon the Pacific Coast Honor Roll.

A few years later we began to hybridize amaryllis and iris. From a few clumps of choice *Iris Kaempferi* have come a garden of magnificent seedlings. The work with amaryllis was broadened to include many of the other amaryllids and has brought increasing fascination.

To my family I have been a trial, late for meals, given to stopping the family car at every beautiful garden throughout the Eastern half of the United States and Canada over which we have frequently toured, lingering overtime in botanical conservatories, and losing myself in plant literature. To my friends I have been an eccentric; to my students perhaps a problem. But, all of them, daughters, neighbors, friends and students pridefully grow in their homes the amaryllids and other flowers that have been given them and crowd the schools when those, there, bloom.

On July 1, I became superintendent of the Ludlow, Kentucky Schools. My hobby has come with me.

A BRIEF HISTORY OF PAINTSVILLE, KENTUCKY AND ITS SCHOOLS

R. G. HUEY, *Kentucky*

Paintsville, county seat of Johnson County, lies along both sides of Big Paint Creek at its junction with the Big Sandy River in Eastern Kentucky. The name has its origin in the crude drawings of wild animals found painted on the precipitous sandstone cliffs of the creek by the early explorers. These drawings and the presence of numerous burial mounds and village sites of a prehistoric people give evidence that the area was commonly frequented by Indians in earlier days.

The early settlers were those who came across the mountains from Virginia and Maryland and into the Valley at its head, the "Breaks of Sandy." Long without roads, and isolated from communication with other sections, except through rafting down the river, the town, like others in the same area, was slow to grow until comparatively recent years.

To Colonel Northrup and John C. C. Mayo, both now deceased, must go the credit for the vision, initiative, and leadership which led to the development of the Big Sandy Valley. Through their efforts Eastern capital was interested in the vast coal deposits and timber resources of the region. The C. & O. Railroad constructed a line up the valley to Paintsville and, later, beyond to the "Breaks." A system of locks and dams was erected on the river. Then, later, two U. S. highways were constructed and crossed at Paintsville. These routes, with trade in coal and timber, opened the way for contact with other sections. Paintsville began to grow and its straggling houses and dirt lanes with dust and mud in season became a community of modern homes and paved streets.

Oil and gas began to be developed and gas from the area is now piped to supply Philadelphia and other Eastern cities. The town rapidly became a business center, the hub of a trading area sixty miles in diameter. It is, today, a thriving and rapidly growing city of the fourth class, with a population of 4500. Its two national banks, three large hospitals, and numerous wholesale and retail establishments, together with its schools and churches, serve a steadily increasing population.

To Mr. Mayo, who looked first into the future, who interested capital in the development of the region, who constructed and landscaped a palatial mansion, who erected and donated to the city a magnificent church building of native stone, and who contributed without stint his time and wealth and influence to public improvements, is due, more than to any other, Paintsville's place, today, in Eastern Kentucky.

The early schools were those of their time and area—crude and limited. In 1888, the first independent school was erected, a three story, ten room brick building. This later burned and another was erected on the same site. In these buildings was carried on all the educational training received by the young people of the community. A rapid suc-

cession of principals and teachers passed through its doors, none remaining longer than a year or so.

In 1912, an additional building was erected on the same lot and the first Grade and High School established. The growth of the school by 1928 necessitated the erection of a third building (Plate 279). At the present time, the Paintsville Schools, with their thirty teachers and 1200 students, are accredited institutions of the highest standing and carry on a modern program of public education, with approximately forty per cent of those who graduate from the high school annually continuing their education in college and university.

Two early private institutions added to the development of Paintsville. The first of these was the Sandy Valley Seminary which after a number of years became the John C. C. Mayo College. Neither institution offered work beyond that of the high school level, but both, through their emphasis upon good literature and their offerings of good instruction in music, contributed a lasting influence upon the town's cultural tastes.

With the coming of the public high school the college closed. In 1938, the site and buildings were purchased by the State of Kentucky and the Mayo State Vocational School established. This is affiliated with the Public Schools and, here, an extensive program of industrial education and training is being carried on.

AMARYLLIDS AS SUBJECTS FOR PLANT SCIENCE STUDY

R. G. HUEY, *Kentucky*

The study of amaryllids in the Paintsville Public Schools began in 1938. If the study of botany was to give to our pupils more than a cursory glimpse into the field of plant science we felt that a thorough and systematic study of some plant family should be undertaken.

The selection of amaryllids for such a study was due, partly, to our already having in the plantings on our school grounds large numbers of hemerocallis, narcissus, and iris, and to the unusual interest shown by the students in a clone of hybrid amaryllis in the superintendent's office. The latter had been received in a shipment of dahlia bulbs from India and was an extremely fine specimen.

Other considerations were that few plant groups afford such a wealth of genera and species for study, and ranging from the common and well known to the very rare. Again, we were influenced by their adaptability to both indoor and outdoor culture, the ease with which they lend themselves to hybridization, the geographic interests which they represented, and the fact that their flowering range gives a season of bloom extending through almost every month of the year. Then, not the least factor was that amaryllids afford unusual beauty and perfection of bloom.

From its inception, interest in the project was keen. Membership in the classes increased until it became necessary to double the number

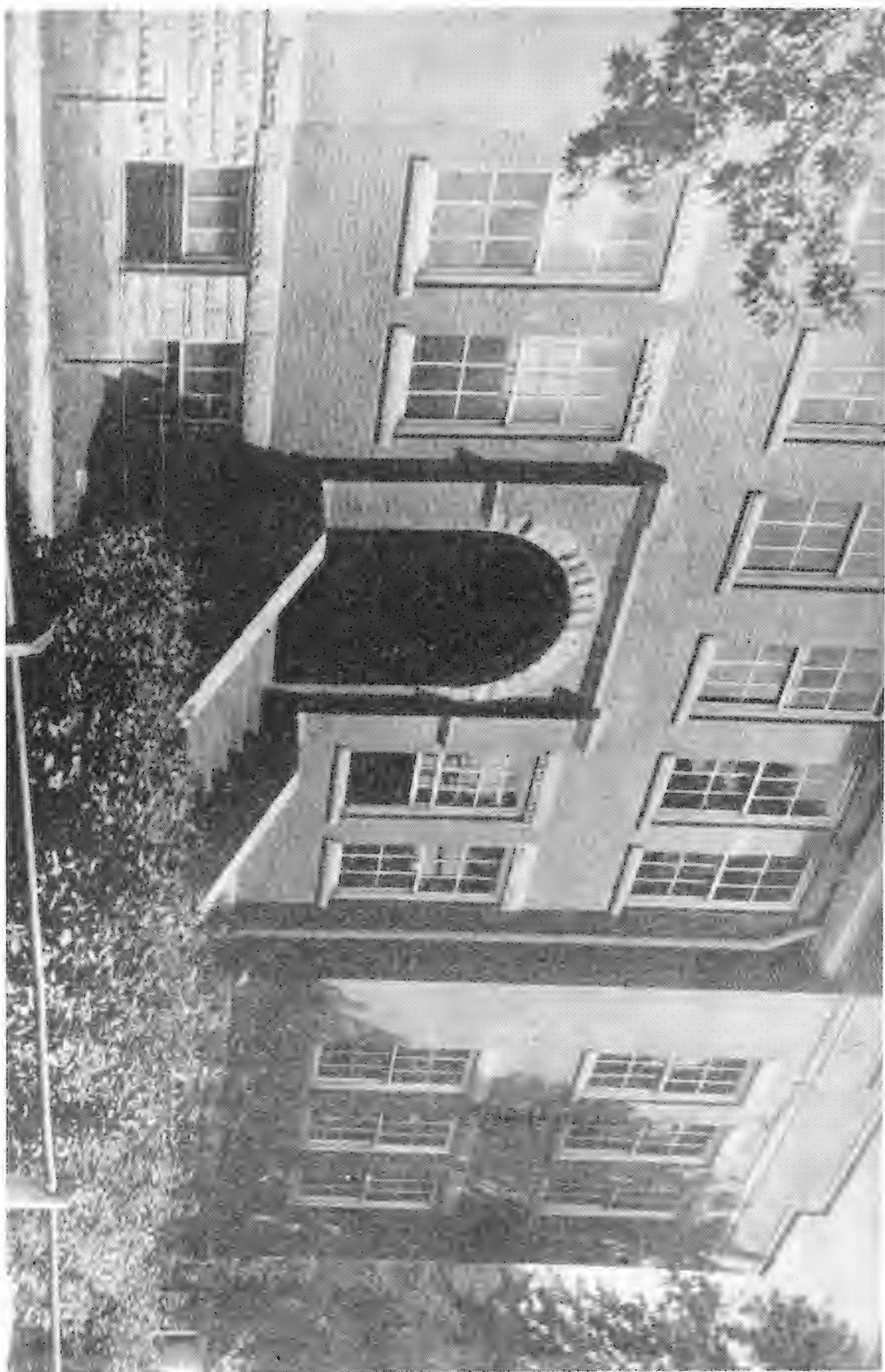
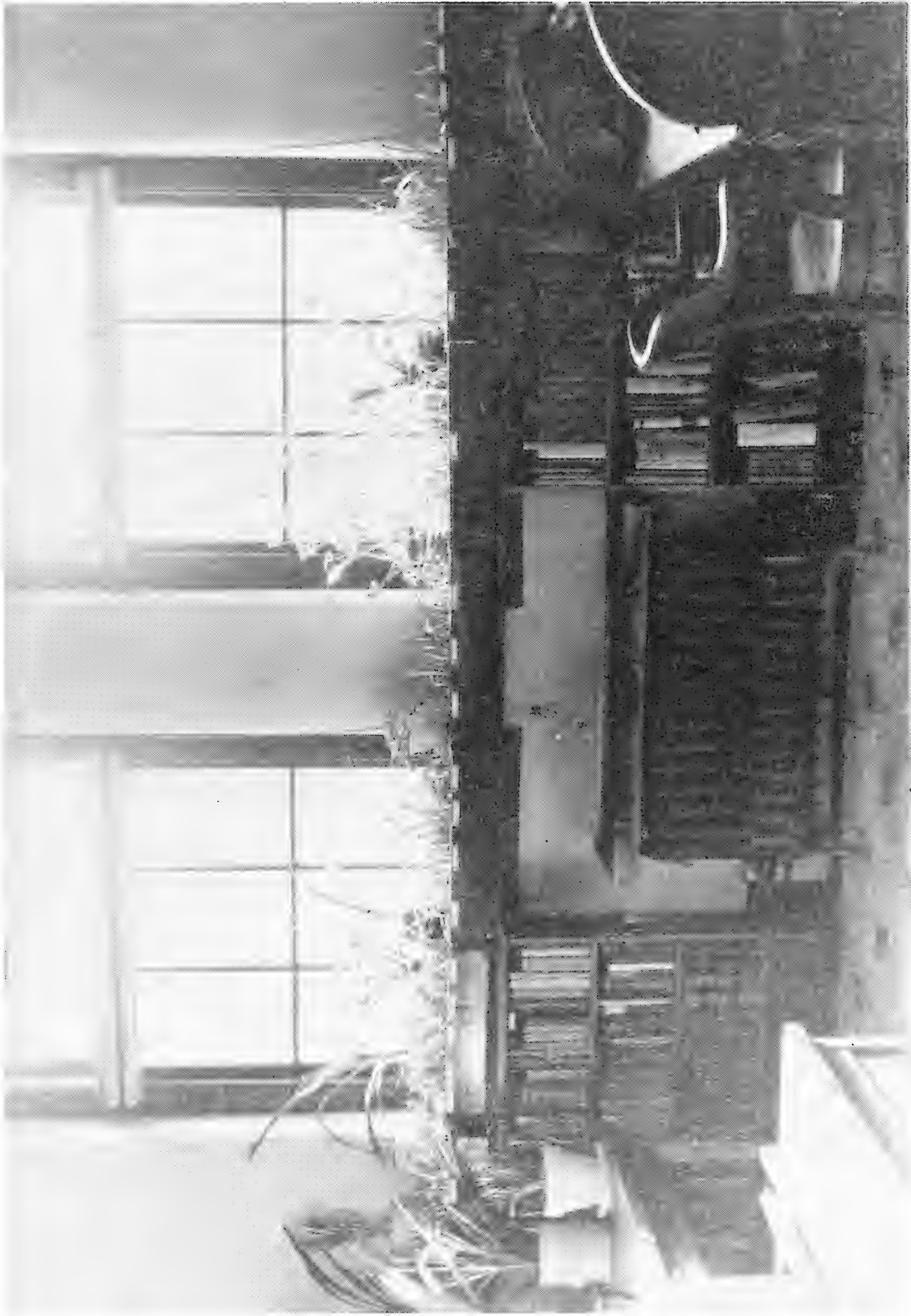


Plate 279

Front entrance to High School building, Painsville, Kentucky



Corner of Supt. Robert G. Huey's office, showing flats of amaryllid seedlings—mostly Nerine, Amaryllis, Brunsvigia, Stenomesson and Cooperia.
Plate 280

of sections. It soon became the most popular department in the school.

The interest has been contagious. During the past year, every home room in the three schools flowered in their windows hybrid amaryllis and other amaryllids. Surplus seeds and seedlings have been annually distributed to interested pupils and several hundred of them are now cultivating and hybridizing amaryllids in their homes. The schools' collection and plantings are visited daily during the flowering season by our own townspeople and by groups from neighboring communities, and information sought.

One of the first aims was to build a good library of reference material. This was collected from various sources; includes books, pamphlets, bulletins, year books, clippings, catalogues, and other material. It is being constantly added to and now comprises probably one of the best collections of general plant literature in the state, as well as the most extensive on amaryllids. Included are all the volumes of *HERBERTIA* except 1 and 2.

Hybridization was undertaken early and has been carried on extensively. (Plate 280). Several thousand seedlings are grown annually and careful records kept. Other trials include the testing of various soils as media of growth, pot and open growth, fertilizers, temperature controls, hardiness, cultural methods, pH requirements and ranges, and the development of color strains.

As already stated, one of our first interests was with hybrid amaryllis and our most extensive work has been with them. To the first Indian clone were added a number personally selected from Florida and Mississippi gardens and a number of Dutch and English hybrids. Later, purchases were made from the strains of Howard and Smith, Houdyshel, Rice, and Hermon Brown. We are under especial obligation to Mr. Brown for having personally selected for us a number of his outstanding individuals during the blooming season, and to Mr. Pierre S. duPont for having sent us a number from his choice collection.

Our *Amaryllis* species include *A. vittata*, *A. Johnsonii*, *A. reticulata* var. *striatifolia*, *A. rutila* and *A. organense*. Other amaryllids in the collection are various *Nerine* species and hybrids, *Haemanthus*, *Stenomesson*, *Crinum*, *Lycoris*, *Vallota*, *Sprekelia*, *Brunsvigia*, *Clivia*, *Urceolina*, *Crinodonna*, *Habranthus*, *Cooperia*, *Zephyranthes*, and *Cooperanthes*.

These have been secured through the purchase of seeds and bulbs, through trading, and through gifts from various individuals. Especially do we acknowledge the assistance and encouragement of Mrs. J. Norman Henry, Mr. W. W. James in charge of the Trial Gardens of the American Plant Life Society, Mr. L. S. Hannibal, Mr. Perry Coppins, Mr. Mulford B. Foster, Mr. A. C. Splinter, Mr. W. H. Brittingham, Mr. O. E. Orphet, and Dr. Hamilton P. Traub, as well as that of Mr. Hermon Brown and Mr. P. S. duPont, already mentioned. A number of former members of the classes, and now in the armed forces, are collecting seeds and bulbs in the foreign lands in which they now serve. Missionary friends have also been a source of information and helpful in locating material.

Any school project must be evaluated to measure its worth. From this one has come, first, a beginning, at least, of appreciation of real plant science and the infinite possibilities for its study. Out of it has grown, second, a far better knowledge of the geography of various lands and a more intelligent interest in their peoples. The study of amaryllids contributes to an international feeling. Correspondence with teachers and pupils, with collectors and seedsmen and hybridizers, with botanists and government officials in other countries has not only brought a far more intelligent appreciation of them and their problems but in many instances genuine and lasting friendships. Interest in a particular plant leads to interest in its native habitat. Interest in its land brings interest in its people. Interest in people strengthens friendship with them. A third outcome has been, we feel, that of a better citizenship. If intelligent interest and inquiring study, if discrimination and judgment in the evaluation and selection of the best, if alertness to changes and results, and if the acquisition of an avocational hobby can be considered desirable citizenship traits, then the study of amaryllids may be said to contribute to that end.

A final contribution from the project must be listed,—that of appreciation and enjoyment. Children's lives are probably more affected and influenced by school surroundings than we commonly recognize. Beauty brings appreciation and happiness. Ugliness leaves us depressed and with a sense of frustration. Beauty of surroundings begets beauty of life. No child or adult can live and work in the presence of beauty without unconsciously absorbing, in some degree, some of its characteristics.

People do not enjoy great music and great paintings until they have been repeatedly brought in contact with them. Neither does the appreciation of the beautiful in nature and the ability to see and recognize and enjoy it come into the lives of children except as it is developed in the presence of it. Once developed, it is a possession that can not be taken away. The poorest laborer, with the capacity to enjoy a perfect flower, the magic of genetic inheritance, or the fathomless mystery of plant life from the buried seed to the full blown flower, has a priceless possession, while the millionaire in stocks and bonds and property, and with no love and appreciation for the beautiful, is only a pauper aesthetically and spiritually.

Beauty makes better people and better citizens and it is my firm conviction that society must recognize that it has an equally great obligation to teach its children to recognize and appreciate and enjoy the beautiful and fine and best in life as it does to teach them the rudimentary arts necessary to the making of a living.

IN MEMORIAM—CARL PURDY, 1861-1945

Herbert Medalist Carl Purdy died August 8, 1946 at Ukiah, California. An autobiography and portrait of Mr. Purdy were included in *HERBERTIA*, Volume 6, pp. 43-45. 1939.

Elmer C. Purdy, the son, writes,—“He passed from life as he had always prayed it would be, fully active and mentally alert to his last breath. He had been grading bulbs for several hours and went into the garden to warm up. There he worked with the hoe for two hours. Passing through the house on his way back to work in the bulb shed, he was stricken with cerebral apoplexy and died instantly.

“The writer, his son, has been business manager of the Purdy enterprise since 1925 for father preferred the production, the more active and open air part of the work. His two sisters and he continue the business, under the name, THE CARL PURDY GARDENS, and under his direction.”

IN MEMORIAM—AUSKER E. HUGHES, 1905-1944

Dr. Ausker E. Hughes, who was Executive Secretary of the American Amaryllis Society in the late 1930's died suddenly in October 1944. In connection with his Society activities he is best known for his article, published in *HERBERTIA*, on the function of the trace elements in Amaryllis growth and development.

The following memorial notice is quoted from *THE WYANDOTTE WIGWAM* of November 1944.

“Gone from among us is Dr. Ausker E. Hughes, supervisor in the Research Department. Gone is a southern gentleman, a friend and tireless worker.

“Dr. Hughes died suddenly on October 23rd at his home near Flatrock. He had just got his car out of the garage and was on his way to work, from which he had not been one day absent for six and one-half years.

“Born in Jefferson, N. C. in 1905, he received the certificate of proficiency in science from Bluefield College in 1925, a B. S. in chemical engineering from Carson and Newman College in 1927, an M. S. in physical chemistry from the University of North Carolina in 1929. He married Miss Lena B. Smithers, who survives him, in 1931, shortly after obtaining his doctorate from the same university.

“Dr. Hughes taught physics and chemistry at Carson and Newman College in 1927; was on the research staff of the Champion Coated Paper Co. at Hamilton, Ohio in 1929; and was chemist for the Bureau of Chemistry and Soils and the Bureau of Plant Industry, U. S. Department of Agriculture in Orlando, Florida for seven years prior to joining our ranks in 1938.

“Dr. Hughes published nine technical papers of note, held several patents, and was a member of the American Chemical Society, the Technical Association of the Pulp and Paper Industry, the Florida Horticultural Society, the American Amaryllis Society, Sigma Xi, and Alpha Chi Sigma.

“Dr. Hughes—Ed to his associates—died in the full vigor of manhood. He was only 39 years of age, strong and sturdy as an oak. His death was a great shock to the many who counted him as a close and personal friend and who admired his qualities of leadership, clear thinking and personal integrity.”

SOUTH AFRICAN NEWS LETTER

R. A. DYER, *Chief*
Division of Botany and Plant Pathology
Department of Agriculture, Union of South Africa

Contributions to HERBERTIA from South Africa have been few and far between during the war period. This is no occasion for excuses. The war disorganised our small white population very thoroughly and it will be some years before research runs smoothly in all branches of science. There are many more vacancies in the professional ranks than there are suitable applicants. Botany is not unique in suffering from a shortage of trained and qualified personnel and it will be several years at least before the position can be satisfactorily restored. Obviously these introductory remarks are made to prepare the way to say that no large work on the Amaryllids is likely to be contributed from South Africa within the near future. In fact there is quite an appreciable amount of leeway to make up in studying the articles on S. A. Amaryllids, which have been published in HERBERTIA by "external" students of our flora since the dedication of volume 6 (1939) to the Amaryllids of the Union of South Africa.

We must for instance not overlook progress in hybridization with *Nerine* recorded by W. M. James in Vol. 7 (1940), or that Dr. Traub gave a clue to the identity of *Cyrtanthus vittatus* Desf. or that Elizabeth Lawrence made observations on *Crinums* in the same number. In Vol. 8 (1941) Mr. James adds some Amaryllid Musings including a reference to an apparently undescribed species of *Crinum* from S. W. Africa. I sincerely hope circumstances will soon enable me to make good my past omission in view of that plant's parental status in hybridization. The genus *Crinum* figures prominently in Vol. 9 (1942) in a review by Dr. J. C. Uphof, and *Cyrtanthus* improves its reputation in the notes by Mrs. Henry, while Mr. Coppens makes reference to *Cybistetes longifolia* and one or two other attractive S. African Amaryllids.

Dr. Uphof continues his contributions with reviews of *Agapanthus* and *Tulbaghia* in Volume 10 (1943). Here we have also a review of *Brunsvigiae* by Dr. Traub and an article on *Brunsvigia rosea* and hybrids by Mr. Hannibal. All these and other miscellaneous references in HERBERTIA including Vol. II (1944) cannot be overlooked in South African botany.

Although I have not been in close touch with HERBERTIA during the war period, the gardener at the National Herbarium, Pretoria, has not allowed the memory to be dulled. He has produced first class blooms of *Amaryllis* from a few specially selected seed kindly sent her a few years back by the American Amaryllis Society. One particularly handsome inflorescence with red and white colouration was photographed in the hope that it might be considered worthy of reproduction in the HERBERTIA (Plate 281). The bulb flowered first in Nov. 1942, the 3rd year from seed, being grown in a 2 lb. jam tin with no special forcing. Other attractive blooms have since been produced by the sister bulbs.



Hybrid Amaryllis—*Pretoria*
Photo by R. A. Dyer, Pretoria

Some of the few contributions which have been made to amaryllid literature in South Africa since 1939 will be reviewed in the next volume of HERBERTIA.

AMARYLLIDS IN ENGLAND AND ON THE CONTINENT

WILLIAM LANIER HUNT, *North Carolina*

It was on the twenty-second of May when a tall English gentleman came over to where I was literally "down on all fours," examining a promising looking composite at Kew for any signs of drought resistance for the Southern United States. The gentleman turned out to be Dr. Hutchinson and his companion, Mr. Holder, one of the assistant curators. We chatted for some time, and among other subjects, Dr. Hutchinson mentioned that great society, the American Amaryllis Society (now the American Plant Life Society) with evident great pleasure. I said that I had been a member almost from the start, and he seemed to recall the photograph of my meadow filled with *Zephyranthes atamasco*.

This was the first of many meetings with English and European scientists and nurserymen during my summer there as a soldier. Everything at Kew and Wisley and at Hampton Court seemed much the same as it was when I was last there in 1927. Some bombs had fallen at Kew and at Hampton Court, but the ones at Kew had had their worst effect, apparently, on the temperate house, and Mr. Raffill had carried on in spite of them. At Hampton Court, Major Hepburn had had several bombs, but the great border against the walls was even more glorious than ever. Major Hepburn intimated that he was going to add even another three feet to its depth. Already it is ten to twelve feet deep!

Allium Macleanii. Putting first things first, in these gleanings from my notes, I shall have to say that of all the amaryllids I saw in seven months, the most exciting one was an onion! Against the wall of the administration building, I saw one day in May the most beautiful head of blue onion flowers on a three foot stem and looking for all the world, at a distance, like an agapanthus of some sort. Surely *A. Macleanii* is destined to lead the onions if this is a sample of the typical plant. The blue of the flowers is bright and clear and carried well in the landscape—so well that I went all the way across the terrace to it at once. In early August, after I had inspected it many times during the summer, it was still in good condition and seemed capable of lasting effectively as a blob of good blue color still longer.

In the several visits I had with the director of Wisley, Mr. Harrow (now retired), we never got around to discussing my favorite onion, but subsequently a request was made for seeds, and the first seed broke through the ground in its pot in June 1946. Perhaps other onion enthusiasts have grown the species.

Alstroemerias. From early summer till late July, the various types of *Alstroemeria* are very much in evidence as cut flowers in Southern England. The great border of different sorts in the experimental garden at Kew flowered from some time in May till the third week in August without a let-up. The most amazing thing about these flowers, from

the landscape standpoint, is that heavy rains pass right through the petalage and leave them looking as fresh as ever as soon as the shower is over!

Major Hepburn has certainly made good use of alstroemerias in the great perennial bed at Hampton Court where the hybrids blend well in almost any combination with other colors because of their having, seemingly, a bit of every other color in their make-up.

Nerine sarniensis and other amaryllids. Never having seen the real *Nerine sarniensis* in flower, bulb enthusiasts will know that I made a special trip to Wisley to see how they compared with the color of our Southern *Lycoris radiata*. The answer in my notes is "a yellower red than *L. radiata* and not as dramatic as to stamens." In the cool house were many fascinating nerine hybrids, *Brunsdonna Parkeri*, the rather more curious than beautiful *Haemanthus coccineus* and numerous other promising looking buds which I was not privileged to see open.

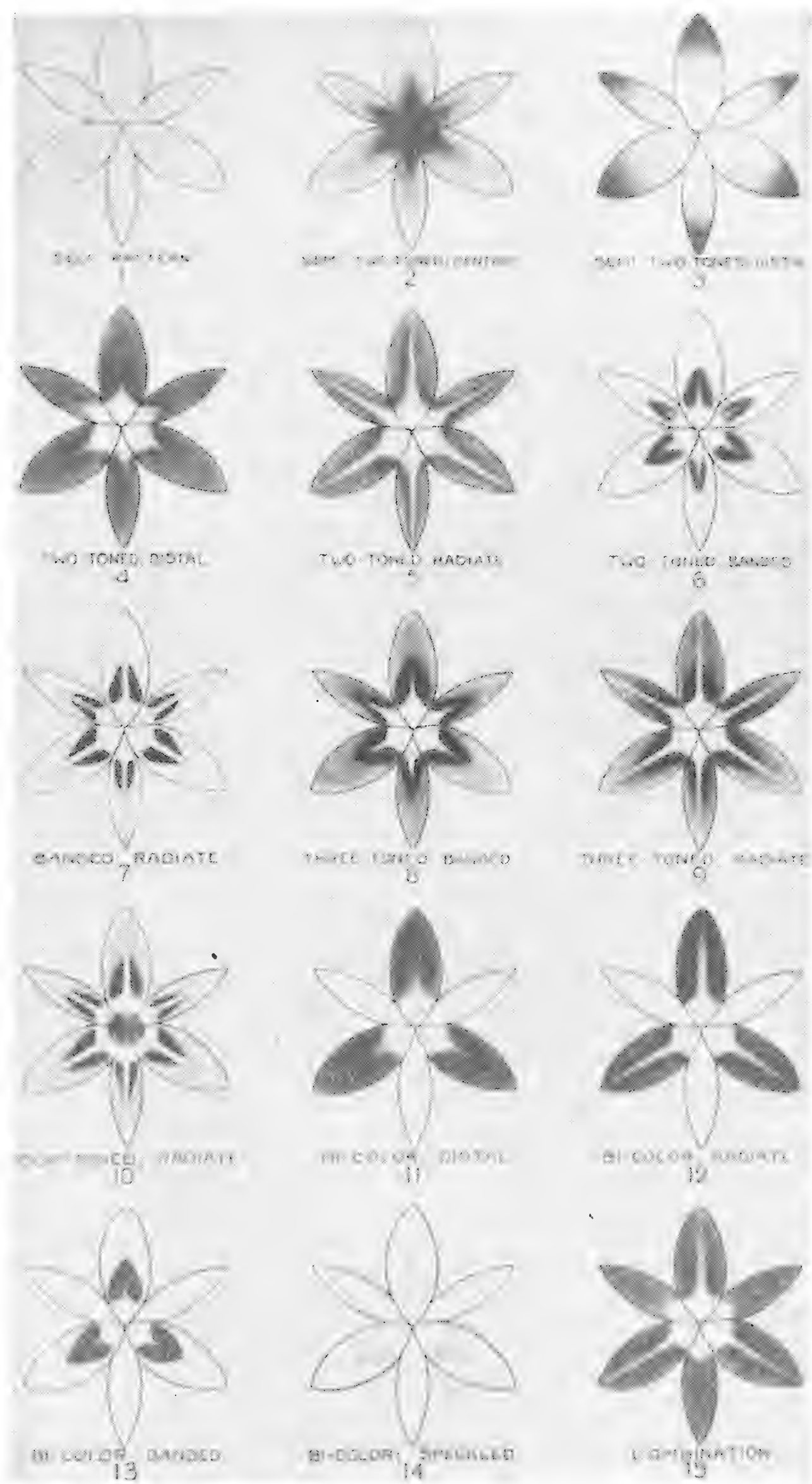
Leucojum autumnale. In the lower section of the rock garden at Wisley, a little bed of the tiny *Leucojum autumnale* bloomed on August 26th. The dainty little foliage looks like nothing more than a new lawn of sprouting winter rye grass, so the wee blossoms are a still wee-er surprise! As Mrs. Wilder said in her bulb book, they are pink and then white.

Brussels. Brussels is, as ever, the clivia city pre-eminent. Everybody has a dog and everybody grows clivias! Fortunately, the Germans did not deny the *Jardin botanique de l'Etat* the coal to keep going and keep their collections of plants from the Belgian Congo alive. The garden is soon to be moved to the country near Brussels because it is planned to put a spur of the railroad from the *Gare du Nord* to the *Gare du Midi* right through the lovely present site of the gardens.

Those who have been there recall the rather interesting circular arrangement of plants in the out-door garden, with the "primitive" families first, followed by the more advanced ones and so on. In this garden the most outstanding group of bulbous plants was a wonderful, old clump of *Nothoscordum fragrans*, a long way from home and doing wonderfully. The bulbs were evidently *not* taken up in winter.

It was on this day, the 29th of August, that the first tulip bulbs were said to be on the way across the border from Holland, and gardeners were eagerly awaiting their appearance. Then, when I arrived in North Carolina on October 22nd, seedsmen had just displayed their first Holland hyacinths.

Nerine Bowdeni and *Sternbergias*. We who think of *Nerine Bowdeni* as something almost rare would be amazed to see them being sold in quantities in the flower markets at Salisbury and around the environs of London. They appeared in vases at the hotels and everywhere in October. Perhaps sternbergias are equally plentiful, but I never saw them except in botanical gardens. The little garden at Bath had the large-flowered, wide-foliaged *Sternbergia macrantha* on October 7th.



Color patterns in **Hemerocallis**. This is Plate 233, from Dr. Stout's article, page 164, *Herbertia* 1942, and is reprinted on request of those interested in daylilies.

1. REGIONAL ACTIVITY AND EXHIBITIONS

AMARYLLID STUDY COURSE

[The following study course on the Amaryllidaceae was prepared by the American Plant Life Society for the Lydonia Garden Club, of McRae, Georgia, Miss Anna L. Crider, Treasurer, in charge of the Amaryllid study program. The course is reproduced here so that other garden clubs may also use it. The ten divisions of the outline correspond to the ten annual meetings of the Lydonia Garden Club.]

AMARYLLIDACEAE (AMARYLLIS FAMILY) STUDY COURSE

[Note.—The student should first consult the references given for each study period, and after a list of genera has been made, then Bailey's *Cyclopedia of Horticulture*, and all the volumes of *HERBERTIA*, from 1 to 11, should be combed for the genera and the species under the genera. *Standardized Plant Names*, ed. 2. 1942 will be of value in evaluating the species that are of garden value. The complete literature citations, abbreviated under the study periods, are given at the end of this outline.]

FIRST STUDY PERIOD. General considerations.

a. *Definition of terms*: (1) Family, as applied to plants; (2) tribe, (3) genus, and (4) species, and sub-specific groups. References: Huxley, 1943; Cain, 1944; *Encyclopedia Britannica*.

b. *General characteristics of the Amaryllidaceae*: (1) leafless scape, (2) spathe of bracts or valves, and (3) umbellate flowering habit. References: Hutchinson, 1934; *HERBERTIA* 2: 73-79. 1935.

c. *Classification of the Amaryllidaceae*. References: *HERBERTIA* 5: 110-113. 1938; Hutchinson 1934; *HERBERTIA* 2: 73-79. 1935.

d. *Nomenclature*. References: International Code; Stevens, O. A. 1945.

SECOND STUDY PERIOD. HEMEROCALLIEAE (Hemerocallis Tribe)

a. *General characteristics of the Tribe*.

b. *Genera, and species under genera*.

c. *Hybrids and their garden value*.

References: Hutchinson, 1934; *HERBERTIA* 2; 73. 1935; Bailey, 1930; Stout, 1934; *HERBERTIA* 5: 110-113. 1938; for daylily hybrids see *HERBERTIA* vols. 2 to 11, and Stout, 1934.

THIRD STUDY PERIOD. AGAPANTHEAE (Agapanthus Tribe) and ALLIEAE (Allium Tribe) .

a. *General characteristics of these two tribes*.

b. *Genera, and species of these two tribes*.

c. *Garden culture*.

References: Hutchinson, 1934; HERBERTIA 2: 77-78. 1935; 10 and 11, 1943 & 1944; and vols. 1 to 11, inclusive.

FOURTH STUDY PERIOD: IXIOLIRIEAE (Ixiolirion Tribe) and BRUNSVIGIEAE (Brunsvigia Tribe.)

- a. *General characteristics of these two tribes.*
- b. *Genera and species of these two tribes.*
- c. *Garden culture.*

References: HERBERTIA 9: 53-59. 1942; Hutchinson 1934; HERBERTIA 2: 78-79. 1935; 10: 51-70. 1943; Bailey's Cyclopedia; HERBERTIA, vols. 1 to 11, incl.

FIFTH STUDY PERIOD: HAEMANTHEAE (Haemanthus Tribe.)

- a. *General characteristics of the tribe.*
- b. *Genera and species of this tribe.*
- c. *Garden value.*

References: Hutchinson, 1934; HERBERTIA 2: 78-79. 1935; HERBERTIA vols. 1 to 11; Bailey's Cyclopedia.

SIXTH STUDY PERIOD. AMARYLLISEAE (Amaryllis Tribe) (Synonym: Hippeastreae).

- a. *General characteristics of this tribe.*
- b. *Genera and species of this tribe.*
- c. *Nomenclature of the genus Amaryllis.*
- d. *Garden value.*

References: Hutchinson, 1934; HERBERTIA 2; 79. 1938; Uphof, HERBERTIA 5; 101-109. 1938; Pam, 1944; HERBERTIA 5: 114-131. 1938; 6: 146-154. 1939; HERBERTIA Vols. 1 to 11, incl.

SEVENTH STUDY PERIOD. ZEPHYRANTHEAE (Zephyranthes Tribe) and CYRTANTHEAE (Cyrtanthus Tribe).

- a. *General characteristics of these two tribes.*
- b. *Genera of these two tribes.*
- c. *Garden culture.*

References: HERBERTIA vols. 1 to 11; Bailey's Cyclopedia; HERBERTIA 2: 78-79. 1935; 5: 110-113. 1938; 6: 65-103. 1939.

EIGHTH STUDY PERIOD. NARCISSEAE (Narcissus Tribe) and GALANTHEAE (Galanthus Tribe).

- a. *General characteristics of these two tribes.*
- b. *Genera and species of these two tribes.*
- c. *Garden culture; and hybrids.*

References: Hutchinson, 1934; HERBERTIA 2: 78-79. 1938; Bowles 1934; Baker, 1888; HERBERTIA vols. 1 to 11; Daffodil Year Books, Roy. Hort. Soc.

NINTH STUDY PERIOD. EUCHARIDEAE (Eucharis Tribe) and EUSTEPHIEAE (Eustephia Tribe).

- a. *General characteristics of these two tribes.*
- b. *Genera and species of these two tribes.*
- c. *Garden culture.*

References: Hutchinson, 1934; HERBERTIA 2: 79. 1935; HERBERTIA vols. 1 to 11; Bailey's Cyclopedia.

TENTH STUDY PERIOD. General Review of preceding study periods; including questions and answers; and score cards and exhibition schedule.

- a. *Review of Amaryllis Family characteristics.*
- b. *Review of tribes and genera.*
- c. *Review of garden culture.*
- d. *Score cards, and exhibition schedule.*

References: (score cards and exhibition schedule): HERBERTIA 5: 141-145. 1938; 7: 125-128. 1940; Colour Chart, Roy. Hort. Soc.

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[Note.—This is a suggestive list; other sources will possibly be available locally. Books should be ordered through the local bookseller. Books marked (*) are technical works, not ordinarily intended for the uninitiated, but are included for they are the only texts that adequately treat the subjects.]

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CLAAR DAYLILY POLL

ELMER A. CLAAR, *Illinois*

Last year I wrote an article for *Better Homes and Gardens*, in which I classified Daylilies in four groups, based on the blooming time of these Daylilies in and around Chicago, and selected Daylilies which I believed to be the best in each individual group. In an effort to secure a wider point of view relative to these groups of Daylilies, I sent the list that I used in *Better Homes and Gardens* to twenty-four people whom I knew to be interested in Daylilies and who have either a large collection or access to seeing a large collection. Eleven of these individuals answered. I believe one of the reasons more people did not answer was due to the fact that I sent my list after the blooming season. Another reason was that some of my color descriptions, although based on the New England Gladiolus Society color chart, which was adopted by our organization several years ago, are not clearly established and comparisons of plants can be made accurately only by direct comparison between individual plants in bloom. It is my intention to send this list out at an earlier date this year to the same individuals, plus anyone else who has a large collection or access to a large collection of Daylilies whose name is given to me.

The first group of Daylilies is for the individual who has never grown Daylilies and who wants a few for a small sum of money. The list that I selected is widely distributed and was accepted in a general way by most of the individuals who replied. However, I shall indicate those who differed from my selections.

In order to accomplish anything of value and to make a start on this kind of poll, I have had to use my own judgment in disqualifying some of the votes on account of the blooming season, color or price, even though I might be accused of being arbitrary. This I hope will be corrected in later polls.

For the individual who has never grown Daylilies and who wants a few for a *small sum of money*, I suggested these:

Group I.

MY CHOICE

Early Bloomers:—

Lemon-yellow *Flava* OTHER SELECTIONS. A Florida grower indicated he preferred *Domestico* or *Semperflorens* to *Flava*.

Yellow, orange back *Gold Dust* *Gold Dust* received 100%.

Orange *Dr. Regel* One vote for *Tangerine*. One vote for *Apricot*, which I list as a cadmium yellow, so the vote is thrown out. One vote for *Aureole*, which is thrown out because it is a rich cadmium yellow in color with faint traces of brownish fulvous.

Intermediate:—

Creamy-yellow *Winsome* The vote for *Winsome* was almost unanimous, but two individuals liked *Modesty*. This is a lovely lemon yellow and should be considered in the running in this class.

Summer Bloomers:—

Light-yellow *Hyperion* or *Patricia* Seven voted for *Hyperion*, two for *Patricia* and one for *Lemona*.

Yellow *Golden Bell* There was absolutely no uniformity of opinion on this class. One individual selected *Circe*, which I am throwing out because it costs \$1.25; one selected *J. R. Mann*, another *J. A. Crawford*; *Dauntless* is thrown out because it is a polychrome, and *Mrs. Wyman* is thrown out because it is a late variety.

Orange-yellow *Ophir* *Ophir* received six votes; *Queen Mary* one, *Stalwart* one and *Mary Florence* one.

Orange *Golden Dream* *Golden Dream* was contested by *Cressida* two, *Goldeni* two, *Midas* one, *Aztec Gold* one. There was no uniformity in this class, which needs more study.

Eyed Variety *Mikado* *Mikado* was practically a unanimous choice, with one vote for *Araby*, which I am throwing out because of price.

Red *Cissy Guiseppe* No one was enthusiastic for *Cissy Guiseppe* but it was opposed by only one vote, *Imperator*. *Cissy Guiseppe* isn't much to look at but it is widely distributed and inexpensive and is the parent of some of the finest red hybrids that we now have.

Polychrome *Fulva* I selected *Fulva* because of its wide distribution. One each selected *Margaret Perry* and *Bardley*. One voted for *George Yeld* and another for *Chengtu*, both of which I am throwing out on account of price.

Late Bloomers:—

Yellow *Multiflora Hybrids* In the inexpensive late bloomers we had three votes for *August Pioneer*, two for *Mrs. Wyman* and one for *Boutonniere*. In my opinion, these plants are better than *Multiflora Hybrids* but more expensive, so I do not consider them but have no objection to any of them.

In the second group I assume that the individual has had a taste of Daylilies with some of the above inexpensive types and that he wants to add another dozen plants and keep the additional cost down to between \$12 and \$15. I made the following suggestions and will comment on them:

Group II.

MY CHOICE

Yellow *Flavina* or *Estmere* OTHER SELECTIONS. Only one differed from these selections and he voted for *Apricot*, so we will consider all three of them.

Intermediate:—

Orange-yellow (large) *Queen of May* *Queen of May* had one affirmative vote and five opposed, two being for *Queen Mary*, one for *Harvest Moon*, one for *Semperflorens*, and one for *Chrome Orange*, which is too high priced for this group. This class needs more study.

Summer:—

Cream-yellow (tall) *Moonbeam* *Moonbeam* was opposed by two votes, one for *Gaiety* and one for *Modesty*. Note that *Modesty* was selected in the inexpensive group also.

Medium-yellow (tall, large) *Hesperus* *Hesperus* was practically unanimous, with but two opposing votes, one for *Pollyanna* and one for *J. A. Crawford*.

Yellow *Golden Bell* *Golden Bell* had three opposing votes, one each for *Giantess*, *Theodore Mead*, and *J. A. Crawford*.

Orange *Mrs. A. H. Austin* *Mrs. A. H. Austin* was opposed by one vote each for *Mrs. C. L. Seith* and *Meg*, *Modesty* and *Patricia* also had one vote each but are being thrown out because they do not belong in this color classification.

Large, showy *Golden West* *Golden West* was opposed by *J. G. Gaynor*. Both of these plants are lovely and are used extensively for hybridizing. There also was a vote for *Rajah*, which is being thrown out because it is not in this color classification.

Polychrome *Linda*, *Geo. Yeld*, *Chengtu* *Linda* had five votes, *Geo. Yeld* two, *Chengtu* two, *Sirius* one and *Dauntless* two. This class needs more study.

Red-orange *Imperator* I was the only one who selected *Imperator* in this class. Among those selected were *Gloaming* and *Sun Gold*. *Byng of Vimy*, *Rajah*, *Hankow* and *Baronet* also were listed but all of them were thrown out on account of price, color or blooming date.

Bicolor *Chisca* One selected *Pandora*, which I grew sometime ago but do not recall as a bicolor. Stout's *Bicolor* and *Festival* got one vote each. However, these are being thrown out on account of price.

Late Bloomers:—

Yellow *Dorothy McDade* There were two votes for *Mrs. W. H. Wyman*, which I will substitute for *Dorothy McDade*. It seems to me

that my choice of *Dorothy McDade* in this group should be disqualified on account of price. I have been growing it for a long time and have a considerable stock, which is the reason for my using it.

In the third group in the Better Homes and Gardens article, I described some of the first introductions of pink, raspberry, rose, red, maroon, ruby-red and purple. Inasmuch as this list merely covered some of the early introductions, I do not think a comparison is worth recording. I think the class should be left out entirely because if it contains anything of superior quality it will be recorded in the selections in Group IV.

Asked by the editor of Better Homes and Gardens to name my favorites among the named Daylilies of each color and class, irrespective of price, I submitted Group IV.

First, however, a word about Groups I and II. In Group I, for example, I would have no criticism of a choice of the early bloomers *Apricot*, *Sovereign*, *Tangerine*, *Gold Dust* and *Dr. Regel*. The same is true of the intermediates or summer blooming varieties in both Groups I and II because they all have been introduced for a considerable period and are relatively inexpensive. It is in the newer classes of pinks, raspberries, maroons, ruby-reds and purples where there is a genuine need for a standard flower with which to make comparison. Everyone will not agree that the flowers selected are the best but it is helpful to have some one or two with which to compare the many others. A flood of introductions is coming. Some eighteen hundred have already been named and with this number there necessarily must be many duplications and inferior introductions that will last only a short while.

Among the individuals to whom I sent my list was Mr. H. G. Seyler, Treasurer of the Farr Nursery Company, Weiser Park, Pa., who wrote me that he had been away for several years and therefore did not feel that he was qualified to make comparisons.

Dr. Traub felt that he was disqualified from voting because of his official connection as Editor. I did not hear from Dr. Stout, Mrs. Nesmith or Mr. Russell. Dr. Kraus was so pressed for time that he could not get his votes together. These individuals have done more than anyone else in the introduction of the new color varieties. Mr. Plouff also has introduced a large number of varieties, which I know he must feel are definitely superior, but inasmuch as the other hybridizers have not voted, I felt that if I had a chance to talk with Mr. Plouff he would instruct me, this year, not to record his votes.

My favorite introduced Daylilies in each color class, irrespective of price:

Group IV.

MY CHOICE

Early Bloomers:—

Yellow *Earliana* or *Elizabeth* OTHER SELECTIONS. *Earliana* favored three to one.

Orange *Judge Orr* Unanimous.

Intermediate Bloomers:—

Creamy-yellow *Winsome Winsome* three votes, *Modesty* one. *Crown of Gold* also received one vote, but I do not believe it is in this color class.

Light-yellow *Little Cherub* There was no uniformity in this vote. *Little Cherub* is my own plant. It has been named but not introduced and for this reason I am throwing it out. I am substituting *Flavinia* and *Estmere* for it. *Star of Gold* and *Gaiety* had one vote each but they are not intermediates as I grow them.

Orange *Queen of Gonzales* This was unanimous except for *Waubun* and *Wekiwa*, both of which are not in this color class.

Red *Wekiwa* *Wekiwa* was much favored in this classification, but there were two votes each for *Sachem* and *Baronet* and one for *Queen Wilhelmina*.

Bicolor:—

Pastel *Symphony* *Symphony* was accepted unanimously except for a vote for *B. H. Farr*, which is not an intermediate.

Strongly contrasting *Zouave* This was unanimous except for one vote for *Chisca*, which is not an intermediate with me.

Polychrome *Dominion* This was unanimous except for one vote for *Lidice* and one for *Brunette*.

Eyed Variety *Gay Couquette* *Gay Couquette* is my own plant. It has been named but not introduced so it should be thrown out of this class. The others receiving votes were Dr. Stout's *Aladdin* and *Buckeye*, which should be substituted.

Summer Bloomers:—

Cream *Vespers* This was opposed by the *Duchess of Windsor*.

Light-yellow *Mongol* Opposed by one vote for *Hesperus*, one for *Mission Bell*, and one each for *Patricia* and *Princess*.

Yellow *Anna Betscher* Opposed by *Golden West* and *Nebraska*, both very fine plants.

Orange *Majestic* Opposed by *The Swan*, *Aztec Gold*, *Nebraska* and *Valiant*. This group needs more study. There also were several votes for *Joanna Hutchins*, Dr. Kraus' lovely seedling, but this is disqualified because it has not been introduced commercially.

Orange-yellow *Golden West* Opposed by *Havilah* and *Golden Sceptre*. I am not acquainted with these although I think I once had *Golden Sceptre*.

Pink *Sweet Briar* *Sweet Briar* had five votes. Was opposed by *Pink Flamingo*, *Helen Wheeler*, *Afterglow* and *Bertrand Farr*. In Group

III, two voted for *Pink Charm* and one for *Pink Lass*, which should be considered in the running. This class is wide open for study.

Raspberry *Piquante* One other individual selected *Piquante*. In Class III *Sweet Briar* was selected. None of the other votes recorded was for this color.

Purple *Potentate* Opposed by *Purple Waters*, *Theron* and *Black Falcon*. Several votes were thrown out on account of being the wrong color. This class is wide open for study.

Rose *Dawn Play* Opposed by *Rosalind*. Several votes thrown out on account of being the wrong color. This class wide open for study.

Red *General MacArthur* Opposed by *Honey Red Head*, *Peony Red*, *Port*, *San Juan*, *Matada*, *Chief Cherokee*, *Red Bird* and *Granada*. This must receive considerable study.

Ruby-red *Royal Ruby* This was opposed by *Ruby Supreme*, *Craemore Ruby*, *Port* and *Royalty*.

Maroon *Marocco Red* or *Wolof* Opposed by *Vulcan* and *Victory Taierhchwang*.

Bicolor :—

Pastel *Debutante* Opposed by *Caballero*, *Afterglow*, *SuLin*.

Contrasting *Bold Courtier* Opposed by *Gay Troubador*, *Athlone*, *La Tulipe*, with *Bold Courtier* having the edge in the votes. Class wide open.

Polychrome *Painted Lady*, *Twinkle Eye*, *Honey Red Head*, and *Dr. Stout* Votes for *Garden Lady*, *Stalwart* and *Duchess of Windsor*. Class wide open.

Eyed Variety *Mikado* *Mikado* received more votes than any other. Opposed by *Jubilee*, (which I am informed is not hardy in the Middle West but is in California and Florida,) *Aladdin*, which I think is an intermediate, and *Jean*, which I do not know.

Late :—

Light-yellow *Autumn Prince* Opposed by *Dorothy McDade*, which blooms much earlier in my garden, and *Hankow* and *Multiflora*, which blooms much earlier.

Many of these will be replaced soon by numbered seedlings which I have seen in various hybridizers' gardens, but the above is a list and something to compare with, no matter what its limitations.

Note.—Several years ago a Southern lady sent me two seedlings, one of which was named *Autumn Sunset* and the other *Hiawatha*. The latter is very fine red clone. I have lost the lady's address, and would appreciate it if she would communicate with me about these daylilies.

REGIONAL TRIAL COLLECTIONS: REPORTS ON REGIONAL DAYLILY TRIALS, 1945

In spite of the difficult war years, the regional trial collections have been maintained, and some progress has been made toward the evaluation of the daylily clones now being tested on a regional basis. It is suggested that daylily breeders, who have not as yet sent their introductions to the trial gardens in their regions, send them directly to the persons in charge of the regional gardens. The addresses are indicated under committees in another section of this issue of *Herbertia*.

1. MILWAUKEE CITY AND COUNTY PUBLIC PARKS

THE DAYLILIES AT WHITNALL PARK, MILWAUKEE COUNTY, WISCONSIN

CHARLES E. HAMMERSLEY, *Milwaukee, Wisconsin*

Many master gardeners throughout the land have been vieing with each other to produce new and better daylilies. Their work has progressed so far that the results are certainly revolutionizing daylily colors and forms. This development will make the daylily one of the most popular of perennials. The season of bloom has been much extended and now we have several varieties that bloom in May, others that do not open until September, and a continuous procession of blooms between these dates.

Many of the newer daylilies produce far more flowers to the stem than the older types and remain open for a longer period. The flowers of some of these newer varieties are very large, up to nine inches in diameter, while others, especially the multiflora hybrids are much smaller but are borne in clusters. The color range now includes not only the older orange and yellow, but we have buff, pink, purples and bicolors in various shades. Some varieties have short grassy foliage, while in others, the foliage is more vigorous, thus offering a large variety.

A rapid development and improvement in daylilies is giving gardeners many splendid new varieties to brighten and charm their gardens. By noting the flowering time one can select a number of varieties that can supply blooms from May until October.

I have been unable to make as many visits to Whitnall Park as I should have liked during the war period on account of gas rationing and the inability to make daily trips, which are necessary to properly evaluate the various varieties. Whitnall Park has a very large number of the newer and better varieties of daylilies. Among the better varieties are the following: *Helen Wheeler*, *Wekiwa*, *Fire Red*, *Sachem*, *Cardinal*, *Peony Red*, *San Juan*, *Victory Taierhchwang*, *Wolof*, *Granada*, *Festival*, *Dr. Stout*, and many others. A more detailed evaluation of the clones in the collection will be included in a future issue of *Herbertia*.

We are greatly indebted to the Farr Nursery Company and Professor Watkins for helping us to obtain this collection.

A list of the 108 clones now under trial in the garden follows:

Ajax	Emily Hume	Modesty
Aladdin	Estelle Friend	Monarch
Amaryllis	Fire Red	Mulleri
Apricot	Florham	Multiflora
Aurantiaca	Fred Howard	Nocernsis
Aurantiaca major	Fulva Cypriana	Ochroleuca
Aureole	George Kelso	Ophir
Autumn Prince	Golconda	Pale Moon
Baghdad	Gold Dust	Patricia
Bardeley	Golden Bell	Peony Red
Baronet	Golden Mantle	Queen of May
Bicolor	Gold Imperial	Queen Wilhelmina
E. A. Bowles	Goldeni	Radiant
Brunette	Granada	Rajah
Buckeye	Gypsy	Reba Cooper
Burbank	Harvest Moon	Rouge Vermilion
Burmah	Helen Wheeler	Royal
Caballero	Hiawatha	Russell Wolfe
Calypso	Hyperion	Sachem
Carnival	J. A. Crawford	San Juan
Chengtu	John Blaser	Semperflorens
Cinnabar	Mrs. John Tigert	Senator Andrews
Corinne Robinson	J. R. Mann	Sirius
Cressida	Kwanso	Sir Michael Foster
Dumortieri	La Tulipe	Summer Multiflora Hybrids
Dr. Hughes	Lidice	Symphony
Dr. Regel	Lovett's Lemon	Tangerine
Dr. Stout	Lovett's Orange	Theodore Mead
Domestico	Mayor Starzyski	Theron
Dominion	Margaret Perry	Triumph
Duchess of Windsor	Midas	Victory Montevideo
Dwarf Yellow	Mikado	Victory Taierhchwang
Eldorado	Mildred Orpet	Virginia
Elaine	Miranda	Wekiwa
Emberglow	Mrs. Wyman	Woodlot Gold
Yeldrin	Yellow Hammer	Zouave

2. DES MOINES (IOWA) PARKS

THE DAYLILY TRIAL COLLECTION AT GREENWOOD PARK

DR. PAUL L. SANDAHL, *Supt. of the Des Moines Park Board*

The garden is located at Greenwood Park on high ground in beautiful landscape surroundings not far from the Iris collection and the rose garden. It is also adjacent to the area where a new art museum will be built in the park this year.

During the war years the garden has not suffered, but it also has not been given the usual kind or amount of fertilization and cultivation that is usually given to push things along. We have had two successive years of abnormal weather which has not been conducive to good growth and bloom. However, on the whole, all plants are alive and growing and prospects now (May 1, 1946) are good for the coming season.

It is not possible to give an evaluation of the clones at the present time but this will be done in future reports. The following plants are in the garden under trial at present:

3 Florham	1 E. A. Bowles	1 Theodore Mead
1 Chengtu	3 Mulleri	1 Russell Wolfe
1 Miranda	1 Bijou	2 Dr. Hughes
1 Aurantiaca Major	3 Queen of May	2 Carnival
3 Gypsy	3 Boutonniere	1 Elaine
3 Yellow Hammer	1 Pale Moon	1 Estelle Friend
3 Ajax	4 H. Aurantiaca	1 Fred Howard
1 Semperflorens	2 Bagdad	1 Duchess of Windsor
2 Mikado	1 Hankow	1 Queen Wilhelmina
3 Fulva Cypriana	1 Dwarf Yellow	1 Rouge Vermilion
1 Shirley	2 Senator Andrews	1 Corinne Robinson
2 Hyperion	1 Emily Hume	1 La Tulipe
2 Ochroleuca	1 Golden Mantle	1 Mildred Orpet
1 Cressida	1 Lovetts Orange	1 John Blaser
3 Golden Bell	1 Goldconda	1 Amaryllis
1 Bardeley	1 Calypso	1 Aureole
3 Virginica	3 Eldorado	1 Anna Betscher
3 Harvest Moon	1 Fire Red	1 Fulva (wild type)
3 Ophir	1 George Kelso	1 Golden Dream
4 Margaret Perry	1 San Juan	1 Kwanso
1 Dr. Regel	1 Peony Red	1 Modesty
1 Mrs. John J. Tigert	1 Helen Wheeler	1 The Gem
1 Lovetts Lemon	1 Victory Taierhchwang	1 Apricot
2 Cinnabar	1 Reba Cooper	1 Bay State
2 Sir Michael Foster	1 Mayor Starzyski	1 J. A. Crawford
2 Nocerensis	1 Granada	1 Gloriana
2 Burmah	1 Dr. Stout	1 Goldeni
1 Domestico	1 Lidice	1 Lemona
1 Sirius	1 Emberglow	1 Mrs. W. H. Wyman
3 Woodlot Gold	1 Victory Montevideo	

3. SOUTHWESTERN LOUISIANA INSTITUTE, LAFAYETTE, LOUISIANA

Prof. Ira S. Nelson writes "During the war we managed to keep the garden intact, and now that things are returning to normal, we hope to make this garden into a very fine display for our section of the Country. Certainly the daylily is as much at home in Louisiana as any plant that we grow."

Prof. Nelson promises a report on the clones under trial for 1946 Herbertia.

4. DEPT. OF HORTICULTURE, UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA

Prof. Watkins writes that on account of the pressure of his teaching load with the many returned war veterans, it is not possible for him to make any report this season. However, we can expect reports in future years.

[REGIONAL DAYLILY TRIALS, continued on page 8.]

2. DESCRIPTION, CLASSIFICATION AND PHYLOGENY

HERBERT'S APPENDIX

H. S. MARSHALL
Royal Botanic Gardens, Kew

Herbert's APPENDIX (containing "Preliminary Treatise," pp. 1-14) was published in London in 1821. The title-page of the Kew copy reads as follows:—

"An /Appendix/ /By/ The Hon. and Rev. William Herbert /[short rule]/ With Plates /[short rule]/ London:/ Printed for James Ridgway, Piccadilly;/ And Sherwood, Neely, and Jones, 20 Pater-noster Row./1821."

There are 52pp. The "Preliminary Treatise" ends on p. 14 and is followed by two uncoloured plates of line drawings of dissections. On p.15 begins "A Treatise &c." containing the descriptions which run to p.46, followed by the "Postscript" (pp.47-50). After this comes the text of *Nerine versicolor* and *Hippeastrum splendens* accompanied by two coloured plates.

According to the Catalogue of the Library, British Museum (Natural History) the work was issued as an appendix to vol. 6 of Edward's Botanical Register. It is described as an appendix to vol. 7 in the Kew Library Catalogue while the entry in Pritzel Thesaurus (1872), p. 141, no. 3983 states "An Appendix (to the Botanical Register)" . . . without giving a volume number. I am, however, unable to find the evidence on which these statements are based, and my efforts in this direction have been restricted by the fact that many of our older periodicals which might contain information on the matter, have been evacuated for the duration of the war, while other London Libraries are in similar case. Botanical Register 6 runs from March 1, 1820 to Feb. 1, 1821, and Botanical Register 7 from March 1, 1821 to Feb. 1822. The "Postscript" in Herbert's APPENDIX is dated Oct. 1821 and in Botanical Register 7 the APPENDIX is cited in literature under tt. 596 & 600 dated Jan. 1, 1822 & Feb. 1, 1822, but it is not cited under tt. 567 & 579 dated Sept 1 & [Nov. 1] 1821 respectively. The APPENDIX would thus appear to have been issued between Oct. & Dec. 1821 considerably after vol. 6 of Botanical Register was finished and while vol. 7 was still in progress. Mr. Stearn has suggested that it was probably published in December (see Sealy in Kew Bull. 1939, p. 66).

In Botanical Register 7 (as in other vols.) a list is given of the books cited in the volume, and among them is "An Appendix by the Hon. and Rev. William Herbert. With plates. London, 1821, 8vo." and it seems strange if the work was really part of the Botanical Register that this fact is not mentioned. Moreover, there is an Index to the first 23 volumes of Botanical Register but Herbert's APPENDIX is not included.

There seems little doubt that the APPENDIX was not issued *with* either volume 6 or 7 of Botanical Register but as a separately published work. Although it was published by the same firm that issued the Botanical Register (and also Herbert's AMARYLLIDACEAE) its connection with that periodical seems to have been very loose. I cannot, however, find any connection between Herbert's Preliminary Treatise and the Botanical Magazine 49 (1822) neither can I find any evidence to show that a 50 page appendix was ever published in the Botanical Magazine.

Cooperia brasiliensis Traub sp. nov.

In 1939, Mr. Mulford B. Foster brought back from Brazil an amaryllid that he had collected while on one of his bromeliad exploration trips. He entrusted this amaryllid to the writer for identification. At the writer's former home, Mira Flores, Orlando, Florida, the plant did not flower apparently because the bulbs were too small. However, from 1943-1944, at 109 Carmel Avenue, Salinas, California, under outdoor culture, the plant bloomed at intervals from spring until fall each season. Later, under greenhouse culture, at Beltsville, Maryland, 1945-1946, it also thrived and bloomed regularly. This amaryllid proved to be a new species of the genus *Cooperia*, the first from Brazil.

It is important to consider first of all the karyology. Preliminary studies on root tips, using Meyer's technique (Stain Tech. 20: 121-125. 1945) indicate that the $2n$, or diploid, chromosome complement of the present species consists of 69 chromosomes plus 1 fragment. Its nearest relatives, when gross morphological characters are taken into account, have smaller chromosome complements—*Cooperia Traubii*, $2n=24$, and *C. Drummondii*, $2n=48$.

The present species differs from *Cooperia albicans* in important particulars. The filaments are not united towards the base, the stigmatic lobes are blunt, round, 1 x 1 mm., the perigone-limb has 3.5 cm. to 4.5 cm. expansion, the leaves are linear, up to 63 cm. long; whereas, in *C. albicans*, the filaments are slightly united towards the base, the stigmatic lobes are spatulate, 3 x 4 mm. expansion, the perigone-limb has a 7.5 cm. expansion, and the leaves are linear-oblongate and only 20 cm. long. The present species differs from *Cooperia Drummondii* var. *Chlorosolen* in a number of characters. It is larger in all its parts, has relatively wider and lighter green leaves, the capsule is green, 1.4 to 1.9 cm. tall, 1.8 to 2.2 cm. wide, very deeply lobed, not narrowed towards the base; whereas, *C. Drummondii* var. *chlorosolen* has narrower, darker green leaves; the capsule has a reddish tinge over a dark green ground color, 1.1 to 1.4 cm. tall, 1.5 to 1.7 cm. wide, not deeply lobed, and narrowed towards the base. The best diagnostic character is therefore the matured scape just before the seeds are shed. The fact that the chromosome complement is different, and the species is readily distinguished from its nearest relatives and is geographically isolated from them, entitles it to specific rank.

Dried specimens of amaryllids, particularly those made by the old drying and pressing methods, are quite unsatisfactory for accurate work. A new and better technique of preserving herbarium specimens of amaryllids is long over due. Therefore, the following description is based on living specimens observed over a number of years. The species is named for the United States of Brazil, its native habitat.

Cooperia brasiliensis Traub **sp. nov.** (1947)

Bulbus tunicatus, collo longo; folia griseo-viridia, 4-7 (saepe 5 vel 6), supra canaliculata, usque ad 6.3 dm. longa et 4 mm. basi lata, apice rotundata usque 1 mm. lata; scapus fere teres, post anthesin elongatus; spatha monophylla, tubulosa; perigonium rectum, 8.5 cm. longum, usque ad 4.5 cm. lata, tubo 7 cm. longo; stamina pistillo paullo breviora, filamentis brevibus, complanatis, antheris stylo approximatis; stigma staminibus longius, obtuse trilobum; capsula viredis, 3-loculata, alte triloba, basin versus non angustata; semina numerosa, complanata, D-formia, exalta, nigra.

Rootstock a tunicated bulb, deeply seated in the soil, the neck reaching to the ground; bulblets freely produced; leaves 4 to 7, usually 5 or 6, gray-green up to 6.3 dm. long, channelled on the upper surface, up to 4 mm. broad at base, and up to 1 mm. broad near the rounded tapered apex; scape 11.2 to 12.3 cm. tall at anthesis, elongating after anthesis assuming a green color, finally reaching up to 4.4 dm. in height, 5 x 6.5 mm. at base, and 4 x 4.5 mm. below the spathe; peduncle at anthesis minutely mottled reddish on green background in upper half, gradually changing to reddish brown toward base, hollow, almost round, somewhat flattened, 5 x 3 mm. in diameter, 11.2 to 12.3 cm. tall; umbel 1-flowered, upright, ovary sessile, 1 cm. long, 4 mm. in diameter; spathe monophyllous, ribbed, rose-red, 4.5 cm. long, united to 2.5 to 3.3 cm. below, tips single, or bifid tips nearly opposite; perigone 8.5 cm. long, tube 7 cm. long, slightly widened at top, faintly ribbed, greenish changing to greenish-whitish at top, limb 3.5 cm. expansion before 6 p. m., 4.5 cm. spread after 7 p. m.; ground color white, perigone-segments broadly lanceolate-acute; sepaline segments 2.3 cm. long, 1.3 cm. wide, with a mucro at tip, faintly tinted rose on outer center, but not as a distinct band, becoming more pronounced to rose or rose-brownish at tip; petaline-segments 2.1 cm. long, 1.3 cm. wide, margins wavy, pure white; stamens 2 mm. shorter than pistil, anthers appressed in a ring around style; filaments white, 2 mm. long, 1 mm. broad, flattened; anthers yellow, subulate, affixed at lower third, 5 mm. long, 1 mm. wide at base; pistil 8.2 cm. long; white, stigma bluntly trilobed, lobes round, 1 x 1 mm.; capsule 3-celled, green, 1.4 cm. high, 1.7 cm. wide, very deeply 3-lobed; seeds numerous, 8.3 ± 0.08 mm. long 4.7 ± 0.01 mm. x 1.6 ± 0.15 mm. wide (on basis of 10 variates), flattened, not winged, black.

The type specimen has been deposited in the U. S. National Herbarium, Smithsonian Institution, Washington, D. C. (No. 1,898,317)

Range.—State of Parana, Brazil, 100 miles northeast of Curybita.

Notes.—This is an interesting species well worthy of extensive cultivation out of doors in sub-tropical climates, and as a pot plant in more

northern locations. Under pot-culture six to eight bulbs, evenly spaced in an 8-inch pot will give a maximum display.

Beltsville, Maryland

HAMILTON P. TRAUB

***Habranthus juncifolius* Traub & Hayward sp. nov.**

In 1940, Sr. Jose F. Molfino of Buenos Aires, Argentina, sent to the Society unidentified amaryllid seeds and bulbs collected by Sr. R. A. Spegazzini "en los campos," Province of Corrientes, Mercedes, Argentina. One of the subjects included in the lot of bulbs proved to be a new *Habranthus* species. It flowered for the first time in the Society's trial garden at Winter Park, Florida in 1941. Later it flowered out of doors at Salinas, California, from 1943 to 1944, and under greenhouse culture at Beltsville, Maryland, from 1944 to 1945. Careful comparison with other species of the same genus has shown that it is in fact a new species. Superficially the usual inflorescence resembles somewhat the rarely-produced two-flowered scape of *Habranthus robustus*, and the individual flowers remind one of *H. brachyandrus*, but the present species is distinct in the character of the leaves (cylindrical, hollow), normal number of flowers (two, rarely three or four per scape), the paracorolla (minute feathery processes), the character of the roots (relatively short, and rather fleshy), and other minor characters.

***Habranthus juncifolius* Traub & Hayward sp. nov. (1947)**

Bulbus tunicatus, collo longo, radicibus brevibus crassisque; folia basi amplexicaulia, 2-5 (saepe 3 vel 4), cylindrica, fistulosa, usque ad 3.5 mm. basi diam., sursum angustata, apice obtusa, 81 cm. longa, griseoviridia; scapus 2-4-florus. (saepe 2-florus), floribus secundariis interdum quam primariis minoribus, fere teres, post anthesin elongatus; spatha deorsum tubulosa; pedicelli longitudine variabili; perigonium plus minusve declinatum, tubo brevissimo, paracorolla processis minutis plumosis prope basin segmentorum composita; stamina stylo approximata; stylus ca. $1/2$ longitudine limbi; stigma trifidum; stamina stylo breviora, inaequalia (4 longitudinum); capsula 3-loculata, alte triloba; semina numerosa, alata, nigra.

Rootstock a tunicated bulb, deeply seated in the soil, the neck reaching to the surface; bulblets rarely produced; roots relatively short and rather fleshy, 1.5 mm. to 4 mm. in diameter; leaves sheathing at the base, 2 to 5, usually 3 or 4, cylindrical, hollow, up to 3.5 mm. in diameter near base, tapering to a blunt point at apex, up to 81 cm. long, gray-green; scape 2- to 4-flowered, usually 2-flowered, flowers may grade from larger to smaller, flower number per scape not a constant character, the same plant may produce 2-flowered scapes at one time, and 3- to 4-flowered scapes at another; scape reddish-brownish-greenish, almost round, 4 mm. x 6 mm. at base, up to 19 cm. tall at anthesis of flowers, but elongating and turning green after anthesis, up to cm. in height; spathe up to 7 cm. long, split almost to base in 3- to 4-flowered, not

so deeply in 2-flowered scapes; upper part greenish, lower part reddish-brownish-purplish, sometimes with two points, sometimes with tips united and open slit below; especially in 3- to 4-flowered scapes, bracts appear as white hairs; pedicels brownish-reddish, up to 4.8 cm. in primary flower, 3.8 cm. in next larger flower, other secondary flowers with correspondingly shorter pedicels; ovary up to 1.1 cm. long, 2 mm. wide at base, enlarging to 3 mm. at top, brownish-green; ovules numerous, central placentation; unopened flower buds red; flowers somewhat declinate; tube very short, reddish-greenish, throat greenish, outer segments up to 5.7 cm. long, 1.5 cm. wide in center, tapering to a sharp pink tinted point, rest of segment very slightly veined pinkish over white, deeper at midrib on outside, except lower part which is brownish-pinkish; inner segments similar to outer, but tips not so pointed; on inside all segments greenish-pinkish in lower part changing to white upwards; paracorolla a very minute feathery process near base of segments slightly above junction of stamens; stamens and style close together, declinate, pinkish in lower $\frac{2}{3}$, upper $\frac{1}{3}$ white; style somewhat more than $\frac{1}{2}$ as long as limb, stigma trifid, stamens shorter than style, of 4 sets of lengths; capsule 1.5 cm. high, 1.8 cm. in diameter, deeply trilobed, secondary capsules may be smaller; seeds numerous, 9 mm. x 6 mm. winged, black.

The type specimen has been deposited in the U. S. National Herbarium, Smithsonian Institution, Washington, D. C. (No. 1,898,318)

Range.—Argentina, Mercedes, Province of Corrientes.

Notes.—The flowers of the bulbs studied proved to be self-sterile, but set seeds freely when pollen from another plant of the same species was applied. Attempts at reciprocal crossing with *Habranthus texanus* and *H. Andersoni* proved unsuccessful.

In California it thrived out of doors and it should also be at home in Arizona, New Mexico and Texas. It may also be adapted to South-eastern United States, but the plant was less vigorous in central Florida. This may have been due to the heavy rains and the relatively lower pH reaction of the soil. It should be tried out in the Upper South, and from New York westward to Iowa and Nebraska.

The plant is deeply seated in the soil. When the bulbs are planted at a shallow depth, they will work themselves down, becoming much elongated in the process. Under these conditions it is very difficult to dig them since the slender bulbs break easily. Under pot culture, it is outstanding. Eight bulbs, evenly spaced are planted in a 6-inch pot for the maximum effect. Water should be withheld from June to the latter part of August. Flowers are produced from two to three times from September to June. The leaves are long and damage or break off easily. To avoid this, a support should be given. Three slender bamboo stakes are spaced in a triangle in the pot so that 8 to 10 inches protrude above the ground. A ring of strong string is fastened near the top of the stakes and the leaves allowed to grow up inside and arch over.

HAMILTON P. TRAUB and WYNDHAM HAYWARD

AMARYLLIS RETICULATA var. STRIATIFOLIA

MULFORD B. FOSTER, *Florida*

I have long been interested in Amaryllids although I have never been known as a grower or fancier. Wherever we go on our collecting trips I always take a few bulbs of any amaryllids that I come upon whether they are in bloom or not. Consequently I have had some most interesting surprises.

My introduction to what I consider one of the choicest of amaryllids was several years ago when I acquired an old colored print of *Amaryllis reticulata* var. *striatifolia* (syn. *Hippeastrum reticulatum* var. *striatifolium*). Its unusual beauty fascinated me.

No association came to mind, however, when I was collecting in Brazil in 1940 and was attracted to seed pods with brilliant orange-red interiors filled with canna-like black seeds. The stalk that supported them rose from a cluster of dark green leaves with a thin milk-white stripe in the center. Little did I realize what these bulbous plants would prove to be. I took bulbs from three different collection areas, and the few which I brought back survived the long journey favoring us with blooms the year after our return. I was, naturally, highly pleased to find that two were *A. reticulata* var. *striatifolia* and that the third one taken from another collecting area was *A. reticulata*. In this connection the reader is referred to a former Volume of *Herbertia*. On page 96, Volume 3, *Herbertia*, 1936, there appears a very good illustration of the typical form of *Amaryllis reticulata* var. *striatifolia*.

The first blooms were hand pollinated; the seeds matured and from them I have raised some very thrifty seedlings. They seem to be happiest in an acid soil and are satisfied with a minimum amount of light.

Every seedling that I have raised from these bulbs has come true—each one from the species variety had clear white center striped leaves. This undoubtedly shows that it is a true native variety and not a horticultural one as has been supposed. The plain green leaf form has produced only plain green leaf offsprings from seed and while the flowers are not as fine in conformation and color and the leaves are shorter, it is nevertheless a worth while amaryllis.

Both of these forms hold their beautiful foliage throughout the year which makes growing them a great pleasure. In fact I think there is nothing in the genus that has such lovely foliage and I would enjoy growing them even if they never showed a flower. The enjoyment of this plant is not limited to the beautiful foliage nor the exquisite, long-lasting, pink and white flowers, but continues through the seed pod stage which bursts open a few weeks later displaying their brilliant orange-red interiors encasing black succulent seeds. This third stage is a show for many weeks.

Three years ago Mrs. Norman Henry of Gladwyne, Penna., kindly sent me a specimen labeled "*H. reticulatum*" which she purchased from Holland several years previous (Plate 283). Now I have been able to compare this with my collected material. The Dutch bulb produces much



Dutch hybrid of *Amaryllis reticulata* var. *striatifolia*
Photo by Mulford B. Foster

larger leaves but the leaf striation is not pure white, rather it is a light green and not clearly defined. The flowers are larger than my collected *A. reticulata* and of a more lavender-pink; the reticulation is not as distinct and the lower sepals do not show the pure white as in the best species variety forms. I feel that possibly this Holland bulb is the result of a cross between the variety *stratifolia* and the species *A. stylosa* or some other species.

I would like to consider more thoroughly the differences in various striated phases of this species. I found the striated phases in low wooded sections where there is a very heavy rainfall in the heat of the summer. I learned from the bulbs which I brought back that they can take much water and can also go long periods without water.

Tabulated descriptions of the various phases follow:

Phase I: species variety; with pure white leaf-striation, has purplish underside leaf; petals have dark pink reticulation and half of two lower sepals and the lower petal is pure white. The lower sepals are distinctly divided in color and the lower inner half is pure white.

Phase II: species variety; leaves are narrower and lighter green with distinct striation; petals and sepals narrower; the lower sepals do not show distinctly the pure white as in Phase I.

Phase III: true species, has the smallest flowers—no distinction in color in lower sepals; reticulation is not as distinct in contrast—the leaves are shorter and broader with no indication of striation.

Of all the bulbs which I found in two different areas, of the variety form, I did not find a single plant without striated leaves, so the characteristic seems to be constant and not just an occasional variegated form as one might expect to find.

Every one of the seedlings of phase No. I and No. II have shown the pure milk white stripe in the center of the leaf.

There are very few ovules, generally not more than 36 in the variety phase but in the Holland bulb which has been known so many years there are generally at least 72 seeds and of course they are not as round and plump as in my collected species, further evidence which makes me inclined to think that the Dutch bulb is possibly one of the original crosses with *A. stylosa* or another species.

All phases send forth bloom (including the Holland hybrid) in late summer or fall.

It has proven to be most interesting and profitable to re-collect known plant material and compare it with what is now in horticulture, especially when it has been almost seventy years (1878) since the first *A. reticulata* was taken.

ALSTROEMERIA CARYOPHYLLAEA

MULFORD B. FOSTER, *Florida*

In 1939 while in the state of Espirito Santo, Brazil, I collected the first *Alstroemeria* I had ever seen but it was a year later when I learned

that it belonged to that genus, and it was six years later when I learned that this beautiful amaryllid was the long lost *Alstroemeria caryophyllaea* (Fig. 135).



Fig. 135. *Alstroemeria caryophyllaea*
Photo by Mulford B. Foster

It had bloomed sparsely in our garden for three years but the plant increased very little in size. Finally, I sent the flower, leaves and photo with my description of the peculiarities of the plant to Mr. Harry L. Stinson in Seattle, Washington, an American authority on this genus. I quote from his first letter:

“It was a thrill to the nth degree to receive your very interesting letter in today’s mail and to lay violent hands upon a species of *Alstroemeria* which I have tried repeatedly to obtain in the Continental [European] gardens. It is one of the oldest in botanical literature but

also the scarcest to obtain. It is *Alstroemeria Caryophyllaea* Jacquin. It fulfills Jacquin's description about 100%."

This enthusiasm, of course, aroused my interest and I then gave my plant special attention. I separated the plant and placed a part of it in the shade of my azalea garden where the soil was much more acid. The plant grew with leaps and bounds; today it is very much at home in Florida. We do not know the lowest temperature that it will stand but no light frosts have affected it so far.

It is very thrilling to find a beautiful flower growing in its native habitat. Still more thrilling to carry it several thousand miles to a new home where it thrives and seems to be very happy, but yet more thrilling later to learn that it is a plant which has been lost for 150 years. This fact gave the whole adventure quite a climax, and my eyes will ever be more alert to the alstroemerias.

This species is ever-green and now that I have it growing in quite favorable conditions it is almost ever-blooming. This past year we had three distinct blooming periods, winter, summer and fall. The main season, however, is from December until March.

The fragrant flowers of this *A. caryophyllaea* which send off their perfume day and night will be a wonderful addition to any sub-tropical or tropical garden. As winter cut flowers they will be much appreciated for their long lasting qualities.

According to Stinson's painstaking research Herbert (5) writes of this *Alstroemeria* that "it is easily cultivated in the stove, requiring absolute drought in the autumn and early winter, and will send up flower stems as soon as it is started in the very early spring, if placed on a hot flue and abundantly watered. When it has done flowering, it may be removed into a cooler situation. Its time for flowering will depend upon the time of ceasing and re-commencing to water it."

But my experience with this species has been that it loves water, good drainage and apparently requires almost no rest at all. The flowers are more brilliantly colored in the winter blooming period than those that bloom in mid-summer. It undoubtedly does best in partial shade.

Mr. Stinson says that it is the only fragrant *Alstroemeria* so far known, and it is pleasant to associate the lovely carnation odor with the beauty of an *Alstroemeria* species.

I am indebted to Mr. Stinson for compiling the following historical data:

"About 1776 there was introduced into the gardens of Europe an *Alstroemeria* which Linnaeus, Jr., took for granted was the same one that his father had accepted from Feuillet's description as *Alstroemeria Ligtu*. Linnaeus Jr., (1) re-described it in his Supplement as *A. Ligtu*. Curtis (2) and Redoute (3) and several others fell into the same error. In 1804 Jacquin (4) correctly described it, and renamed it *A. caryophyllaea*, because of its carnation-like odor and because it was not the *A. Ligtu* of Feuillet."

Mr. Stinson further states that:

"According to Jacquin's account it soon perished and was not in general cultivation. Herbert gives a few cultural directions for it in his

Amaryllidaceae, (quoted above) so he must have been familiar with it. Since then I find no reference to it in literature, nor have I seen it listed in any catalogue."

I am further indebted to Mr. Stinson for passing on to me the following historical data translated from Jacquin, Schoenbr. vi. 33 t. 465 (1804):

"*Alstroemeria* with an erect stem; spatulate-like leaves, sessile, pressed up tight on the flowering stem; on the sterile stem there are others besides the top ones, longly lanceolate, petioled and scattered; corolla two-lipped.

"The entire plant is glabrous. The perennial stems grow from the fasciculated tubers, which are round, about as thick as the little finger, obtuse, an inch long, fleshy, dirty pale color, sending out fibrous branches from the apex. Many annual stems, inclined to be suberect, round, greenish and becoming purplish, clothed with spathe-like leaves, lying up flat to the stem and far apart; some are sterile, slender, 3-9 inches long, be-decked on the top with many leaf-like, alternate leaves; others carry a few flowers, the thickness of a dove's feather, without leaves, longer, terminate in an involucre umbel. Leaves are petioled, narrowly lanceolated, sharp on both edges, entire, three veined, open, 1-3 inches long. Leaflets of the involucre many, lanceolate-linear, entire, very much open and erect, some twice shorter than the peduncles, others tolerable longer. Peduncles more or less in fives, erect, round, upper part six grooved, 1-inch. Petals six, in one row, acute, open, two-lipped, unequal, lanceolate from the channeled claw; the three lowermost ones flexed and entirely red, with the middle one smaller and shorter; the three ascending ones white with the topmost part red, middle one quite long. Filaments six, awl-shaped, smooth, declined, unequal in length. Anthers oblong, erect and red. Ovary inferior, obverse-ovate, green, six grooved. Style shorter than the stamens, reddish; stigma opening very wide into three linear divisions. The odor of the flowers is of the aromatic carnation.

"Linnaeus, Sr., in his "Systema and Species of Plants" took for granted the species of the *Alstroemeria* from Feuillet; but he abstained from describing plants which he had not seen. While on the other hand, I do remember having seen this plant in flower under the title of *A. Ligtu*, thirty years ago (1774) in the gardens of Caesar Schoenbrunn. The plant afterwards perished. Not only have I described it, but I have also illustrated it. In so far as I recall, this plant which I have called *caryophyllaea* on account of its odor is not Feuillet's *Ligtu*, although it is similar to his drawing and has been taken for *Ligtu* in Botanical Works.

"Native country is unknown. It flowers in the warm climate during December and January."

After a century of confusion it has been a great satisfaction to re-introduce this delightful *Alstroemeria* species to northern hemisphere gardens.

REFERENCES

(Furnished by Harry L. Stinson)

1. Linnaeus f., Suppl. to Species Plantarum, 206-207. 1781.
2. *Alstroemeria Ligtu*, in Curtis' Bot. Mag. t. 125.
3. Redoute, Les Liliacées, 40-46. 1802.
4. *Alstroemeria caryophyllaea*. Jacquin, Schoenbr., VI, 33, t. 465. 1804.
5. Herbert, William, Amaryllidaceae, 1837, p. 89.

ALSTROEMERIA LIGTU

HARRY L. STINSON, *Washington*

Since the time that Father Feuillet found and described *Alstroemeria Ligtu*, there has been confusion and doubt in the minds of many great botanists as to which type he referred. This name "Ligtu" has been given to several types due to this uncertainty, showing that they did not fulfill the original description, which was considered to be quite inadequate.

During several years study and observation of these various types called "Ligtu," I have been unable to bring myself to the conclusion that we had in cultivation the true type of Feuillet. Endeavoring to reach a final conclusion I have imported seeds and plants from every source that I could contact. Finally, I received some seeds, which I was given to understand were from stock collected by Dr. T. Harper Goodspeed and his party of botanists on their recent Botanical Trip to South America. Among the plants from these seeds were a few which were definitely not like the others. They plainly exhibited characteristics in keeping with Feuillet's description, and when they bloomed and produced seeds, all doubt was removed. The two upper interior petals contained white, just as Feuillet had said they did. The seeds are less than one half the diameter of other species (Figure 136).

Since Feuillet's Journal is very rare and not to be found on every library shelf, I will give here for your pleasure and information a translation of his *A. Ligtu*.—

"The roots of this plant go in obliquely, it has thickened tubers covered with some little short hairs, it is round, three lines thick, and covered with a whitish skin. Its stem arises obliquely to the height of a foot, following the same direction as the roots; it is winged, covered with a reddish-brown bark, round, crowned with six or seven leaves, from between which emerge as many branches which bear several flowers at their summits.

"The leaves which are borne the length of the stem are placed on all sides, they embrace half the stem by their bases, their length is in the vicinity of two and three-quarter inches, their width some five lines, they are a bright green, end in a point, and are traversed for their length by several little ribs which originate at the base and continue to the extremity of the leaf.

"The flowers are borne on the young ovary of the fruit at the end of the peduncle of a beautiful green. This young ovary is ridged its

length with five [this is an error and should be six] ribs, and they carry a flower of a beautiful red, which is divided into six parts, two of which are streaked with white bands which form acute angles with the ribs of the same color which traverse their length. These are narrower and more pointed than the other four, which are $1\frac{5}{16}$ inches long and 9 lines wide. I have not seen the fruit, having been obliged to leave before its maturity.

“This plant is found along streams. I noticed this one along the river which passes through the center of the village of Conception in the Royalty of Chili.”



Fig. 136. *Alstroemeria Ligtu*
Photo by Harry L. Stinson

The following description was made from one year old seedlings grown at Seattle, Washington,—

“Stems several, erect, simple, glabrous and glaucous, round, slender, reddish-brown, $\frac{3}{16}$ to $\frac{1}{4}$ inch in diameter, 24 inches high, not inclined to be rosulate, solid, leaves scattered along the entire length.

“Leaves ovate-lanceolate, acutely pointed, entire, *no cilia*, blade $\frac{3}{16}$ to $\frac{5}{16}$ inch wide, 3 to 5 inches long, narrowing into a petiole $\frac{1}{8}$ to $\frac{3}{16}$ inch wide. sessile and clasping the stem about half way, slightly glaucous and shiny on top, resuspinate, lower leaves on the stem more scale-like, becoming more leaf-like up the stem, prominently veined on the bottom, 7 veins, no pubescence on the veins.

“Roots fasciculated, filiform, tuberous portion about 2 inches long, $\frac{5}{16}$ inch in diameter, covered with a whitish pubescence, white skin, brittle, sweetish to the taste. [I can give more information on the tuberous roots after I dig the mature plants this fall].

“Peduncles umbellated, 2 to 3 inches long, involucreal leaves as many or one more than the number of peduncles, linear-lanceolate, acute, 2 to 3 flowers on each peduncle, pedicels about one inch long with a small linear-lanceolate bract at the point of branching.

“Flowers about $1\frac{1}{2}$ inch wide, almost 2 inches long, oblique-erect, three outer segments pink, obovate, apiculated, reflexed, slightly crenulated, not finely serrated, the upper one shorter and more reflexed. Three inner segments wedge-shaped, narrower than the outer three, upper two the longest, channeled at the base, erect, center portion white, with maroon lines running out fan-shaped from the base, very sharply pointed, upper portion pink, lowermost one the narrowest and entirely pink.

“Capsule about $\frac{1}{2}$ inch in diameter, six sided with six ribs.

“Seeds many, small—about $\frac{1}{32}$ to $\frac{3}{64}$ inch in diameter.”

I believe this *Alstroemeria* species will prove to be as hardy as the *A. chilensis* hybrids, as it comes from about the same locality in Chile. After I have grown it for a few years I will learn more about it and may arrive at different conclusions as to its cultural requirements.

Feuillet could not have sent seeds of this plant back to France for he writes that he was obliged to leave before the plants were mature. Ruiz and Pavon, two famous Spanish botanists, were the next to visit this region and they mention having found this *A. Ligtu* on their trip back to Conception from Culento, [an haciendo twelve leagues East of Conception and on the same river—Rio Andalien—on which Feuillet writes that he found it growing.] Ruiz makes no reference in any of his lists of having sent seeds or tubers of this alstroemeria back to Spain. I do find where they sent seeds of *A. pelegrina* and a sample of flour (liutu) made from the tubers of the alstroemerias by the Chileans. The shipment containing sketches and specimens of *A. Ligtu* were lost in a ship wreck at sea. Dombey, the French Botanist, accompanying Ruiz and Pavon sent his cases from this area on a different ship and they arrived safely, but I find no record of the contents of his cases so have no idea if they contained our plant. A visit to the Herbarium at Paris would be extremely interesting and possibly profitable.

At the time (1754) Don Claudius Alstroemer went to Cadiz, Spain, to assume his duties as commercial advisor to the Swedish Consul, Don Bellman, he found *A. pelegrina* being grown for the beauty of their flowers, but nowhere is there any reference to seeing *A. Ligtu*. Linnaeus was quite enthusiastic about *A. pelegrina* but barely mentions that Feuillet had found and described another called, “Ligtu.”

Linnaeus, Jr., assumed that the Brazilian species, *A. caryophyllaca*, was the same as the one his father had taken from Feuillet's description as *A. Ligtu*, and described it in his Supplement as such. Mr. Curtis in Bot. Mag. and Redoute in his "Les Liliacées" and others fell into the same error. Herbert, in his "Amaryllidaceae," writes that the name "Ligtu" was given by "a great and unaccountable error in the Bot. Mag. to a tropical plant, in no way resembling it, which has been generally cultivated under a wrong name, being properly *A. caryophyllaea* of Jacquin." Curtis admits that this plant does not fit Feuillet's description but it has gone under this name for so long a time that it would be useless to correct the mistake.

Dr. Goodspeed in his interesting and informative book, "Plant Hunters in the Andes" mentions having seen the pink *A. Ligtu* growing near the summit of the Andes along the Trans-Andean Railroad. I am wondering about this. If convenient I plan to go through his herbarium specimens this summer to see what it is.

The search into the history of *A. Ligtu* has led to some interesting experiences, one of which was Ruiz's reference to having found alstroemerias in the "Province RERE." Days and days I spent days and days in looking through old geographies and encyclopedias for this old province, with no success. In desperation I thought it might be a Latin abbreviation, so spent more days tracing down about every irregular verb in the Latin grammar. Still no luck. Here the matter stood until I was able to get a translation of Ruiz's "Travels in Peru and Chile" by the Field Museum of Natural History. This solved the mystery, for here it was, a province East of Concepcion, Chile, later incorporated into a larger province.

In conclusion, I am of the opinion that all the alstroemerias that we have been growing in our gardens under the name of *A. Ligtu* are varieties and hybrids of *A. chilensis*. Kunth in his "Enumeratio Plantarum" Pl. v., page 778-91, states that several forms are grown in the Royal Horticultural Garden of Berlin. My observations lead me to believe that about four forms or species have become so thoroughly hybridized that it is almost hopeless to separate out the true types involved and give them a species standing. As difficult as it may be I am endeavoring to take seeds from the various forms to see if they by chance might throw some light upon their parentage.

The name "Ligtu" is euphonious and has historical interest to the alstroemerian, but I have no doubt that the flowers will be just as beautiful under the name "*chilensis*" as they were as *A. Ligtu* when parading incorrectly under the name, *A. Ligtu*.

LEUCOCORYNE AND RELATED GENERA OF SOUTH AMERICA

J. C. TH. UPHOF

The beautiful Glory of the Sun, *Leucocoryne ixiodes* var. *odorata*, illustrated in color on the Plate facing page 126, in Volume 3, 1936, of HERBERTIA, is fairly well known in American gardens, but the remainder of the species in the genus *Leucocoryne*, and the related South American genera *Tristagma* and *Steinmannia*, and the South American portions of the genera *Nothoscordum*, *Brodiaea* and *Triteleia*, are little known. Representatives of these genera are rare in collections of living plants, and even in herbariums of the larger institutions there are but a few specimens to be found for study and comparison. Detailed descriptions of these little known genera and species are given in the following pages in the hope that these "orphans" may receive more attention in the future.

1. THE GENUS LEUCOCORYNE

The Genus *Leucocoryne* was described in 1830 by John Lindley, Professor of Botany in the University of London, in Edward's Botanical Register¹ where we find on plate 1293 a colored illustration of *Leucocoryne odorata* which he calls in English "Sweet-scented Leucocoryne." Opposite this hand-colored plate we find the first description of the genus. The name *Leucocoryne* he derives from the Greek [=white and club] "in allusion to the club-like sterile stamens." That same plate gives us also a longi-section of the flower, showing along the throat of the perigone peculiar appendages that represent the staminodes or sterile stamens. Lower down toward the middle of the perigon tube, the normal fertile stamens may be seen. Lindley says: "From *Brodiaea* this genus differs in the texture of its sterile stamens, and in the place of the insertion of its fertile ones; it is also distinguishable by the want of the hypogynous scales, which although not much developed in *B. congesta*, undoubtedly exist in *B. grandiflora*, where, however, they have been overlooked by Dr. Hooker in the Botanical Magazine, both in his figure and description."

A year later there was published in The American Journal of Science and Arts² a contribution on plants, collected by Bertero in Chile. On page 301 we find the first mention of *Antheroceras*, "A new genus, which bears great resemblance to the *Sowerbaea*, Smith, originally from New Holland. There are two species; the *A. ornithogaloides*, (Guill.) and the *A. odorum*, Bertero, (Guilli de San Francisco). They grow in sterile and stony pastures; the first on the mountains, the second on the plains. Both merit cultivation." From this statement it is

¹ J. L. [indley], *Leucocoryne odorata*. Pl. 1293. Edward's Botanical Register. 1830.

² W. S. W. Ruschenberger. List of the plants of Chile, by Dr. C. Bertero; translated from the "Mercurio Chileno" and forwarded for this Journal. Am. Journ. Science and Arts. 19:301, 1831.

difficult to derive any relationship to *Leucocoryne*, Lindley. However, in a later publication written by Baker³ we notice that *Antheroceras* [he prints here *Anthoceras*, Bertero, MSS.] is considered a synonym of *Leucocoryne*. There are some other interesting items in the history of nomenclature of this genus and its species, that may be mentioned. Lindley in Botanical Register gives us a description of *L. odorata* with a colored plate opposite the text. On the next page we find also a short description in Latin of *L. ixiioides* giving as synonym *Brodiaea ixiioides*, Hooker, and referring at the same time to the description and thus also to plate 2382 of Curtis' Botanical Magazine 1823. The next species that is described by Lindley is *L. alliacea*, with *Brodiaea alliacea*, from Miers' travels, as synonym.

From colored Plate 1293 in Botanical Register and Plate 2382 in Botanical Magazine, one concludes that there must be two distinct species involved, namely *L. odorata* and *L. ixiioides*, yet in the publication of Baker, the two are grouped together as one species, namely *L. ixiioides* Lindl., with *L. odorata* as a synonym.

Genus LEUCOCORYNE Lindley

Lindley, Bot. Reg. pl. 1293, 1830; syn. *Antheroceras*, Bert., American Journal Science and Arts, 19:301, 1831; *Loucoryne*, Steud. Nom. Ed. 2 II. 38, 1841; *Anthoceras*, Baker, Journal Linn. Soc. 11:374, 1871.

Bulbous plants; leaves narrow, linear; scape simple; flowers conspicuous, grouped into umbels, surrounded by two linear-lanceolate, membranous bracts; perigone-tube cylindrical or drawn together above the ovary, longer or shorter than the lobes; tepals long-ovate, or narrowly extended; stamens 3, opposite the outer tepals, enclosed in the tube of the perigon; filaments very short, anthers long-linear; staminodes 3, enclosed by the tube, linear or widened toward the base, no remnants of anthers visible; ovary elongated, rounded off at the apex, 3-ribbed; style short with a small stigma; fruit a membranous capsule, ovate or longish; seeds black, many, small, spherical.

Fourteen species of *Leucocoryne* are recognized. These are all native to Chile. Lindley, who founded the genus *Leucocoryne*, placed the description of *L. odorata* before those of *L. ixiioides* and *L. alliacea*. Baker reduced *L. odorata* to a synonym of *L. ixiioides*, and the latter is therefore the nomenclatural type of the genus.

DESCRIPTION OF SPECIES

1. *Leucocoryne ixiioides* Lindl., Bot. Reg. sub. t. 1293, 1830; Kunth Enum. Plant. 4: 473, 1850; C. Gay Flor. Chil. 6: 121, 1853; *Brodiaea ixiioides* Hook. Bot. Mag. t. 2382, 1823; *L. odorata* Lindl. Bot. Reg. t. 1293, 1830; *Antheroceras odorata* Bertero, Journ. Am. Science. 19: 301, 1831; *L. narcissiflora* Phil. Flor. Atacam. 52, 1860.

Description.—Bulb roundish, 12 to 18 mm. in diameter, tunicate; leaves many, green, 16 to 24 cm. long, 2 mm. wide; scape erect, fragile,

³ J. G. Baker. A Revision of the Genera and Species of Herbaceous Capsular Gamophyllous Liliaceae. Journ. Linn. Soc. 11:374-375, 1871.

fistulose, 15 to 25 cm. long; spathe-valves linear-acuminate, 24 to 30 mm. long; umbels 3 to 12-flowered, pedicels 18 to 36 mm. long; perianth 18 to 30 mm. long, light violet; segments lanceolate-spatheolate, 5 to 6 mm. wide; staminodes short.

Notes.—*L. odorata* Lindl. Bot. Reg. t. 1293, 1830 is considered by Baker as belonging to *L. ixiioides* Lindl. He states “*L. odorata* est mera forma pedicellis brevioribus.” Lindley says that “this pretty little plant was found by Mr. M’Rae in November 1825, along with two other species, upon the sides of the mountains lying between St. Jago and Valparaiso, in places where the snow has been a few days melted.” The plant was received from Mr. M’Rae by the Horticultural Society in the spring of 1826 and flowered for the first time in August of the same year.

2. *Leucocoryne angustipetala* C. Gay. Flor. Chil. 6: 124, 1853; Baker. Jour. Linn. Soc. 11: 375, 1871.

Description.—Bulb 16 to 18 mm. in diameter, tunicate; leaves many, firm, 15 to 25 cm. long; scape 12 to 20 cm. long; spathe-valves 16 to 18 mm. long; umbel 3 to 4-flowered, pedicels 6 to 12 mm. long; perianth 10 to 12 mm. long, pale purple, segments linear, acute; staminodes linear, acuminate.

Notes.—Has been reported to be native to Chile.

3. *Leucocoryne macropetala*, Phil. Linnaea 29: 74, 1857-58.

Description.—Umbel 3 to 5-flowered. Spathe-valves narrow; pedicels double the length of the tube of the flowers; flowers white, 16 to 20 mm. long, lobes of the perianth linear to lanceolate, reflex; tube long; staminodes broad, cylindrical.

Notes.—Native to Chile; La Sercna leg. el Gal Herb. Chil. no. 449.

4. *Leucocoryne alliacea*, Lindl., Bot. Reg. t. 1293, 1830; Hook. et Arn. Bot. Beech. 48, 1840; Kunth. Enum. Plant. 4: 474, 1850; C. Gay Flor. Chil. 6: 123, 1853; *Brodiaea alliacea* Miers. MSS.; *Antheroceras Ornithogaloides*, Bertero, Jour. Am. Science. 10: 301, 1831.

Description.—Bulb ovoid, 18 to 24 mm. in diameter, truncate; leaves many, green, 12 to 16 mm. long, 2 mm wide; scape 12 to 24 mm. long; spathe-valves linear-acuminate; perianth 16 to 18 mm. long, pale violet; segments linear; staminodes linear, acuminate, 6 to 8 mm. long; flowers are united into 2 to 4-flowered umbels; pedicels 6 to 8 mm. long.

Notes.—This species is native of Chile.

5. *Leucocoryne coquimbensis*, F. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 273-274, 1896.

Description.—Leaves narrow linear; 28 mm. long and 2 mm. wide, bright green; scape produced after the leaves, about 35 cm. long and 2 mm. wide; umbel 2 to 5-flowered; spathe scarious, linear, reaching about the middle of the limb of the perianth; perianth hypocrateriform, violet and white toward the base of the limb; tube greenish, about 11 mm. long; staminodes yellow, conical, 4 mm. long.

Notes.—This species was first found near Coquimbo, Chile, September 1893. It is apparently related to *L. purpurea* from which it differs by the almost white throat of the perianth and the yellow staminodes.

6. *Leucocoryne connivens*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 273, 1896.

Description.—Leaves usually 3 in number, somewhat grooved, linear, 2 mm. wide; scape 3-flowered, 22 cm. high and, like the leaves, bright green; spathe dry, purplish at the base, 2 cm. long and more or less of the same length as the pedicels; limb narrow campanulate, 16 mm. long and 5 mm. wide; lobes much longer than the half of the flower, a little grooved, white; staminodes 9 mm. long.

Notes.—Native to Talca, Chile. Philippi mentions that a bulb which was collected in Talca flowered in the Botanic Garden.

7. *Leucocoryne incrassata*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 272-273, 1896.

Description.—Umbel about 7-flowered; pedicels long subequal, 2 to 4 cm. long; spathe about 30 mm. long; lobes of the perianth oblong-lanceolate; tube 11 mm. long; staminodes oblong.

Notes.—This species was first reported from Vallenar, Chile, February 1883, by Belisario Rojas, Philippi mentions that this is the only species of *Leucocoryne* that flowers at the end of the summer; the others flower during the spring.

8. *Leucocoryne foetida*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 272, 1896.

Description.—Bulb about half the size of that of *L. odorata*; leaves narrow linear, 25 to 30 cm. long and 2 mm. wide; umbel 3 to 5-flowered; scape 25 to 30 cm. long, purplish at the base; spathe as long as the pedicels; pedicels 13 mm. long; lobes white or pale violet, ovate-lanceolate, acuminate, 29 mm. long and 9 to 10 mm. wide; staminodes light yellow.

Notes.—This species was first reported from Quilpué, Chile. The plant gives off a strong odor which is much more pronounced than in *L. alliacea*. This species differs from *L. ixioides* and *L. odorata* by its lesser number of flowers to each umbel; from *L. montana* by its shorter pedicels and from *L. pauciflora* by its shorter staminodes.

9. *Leucocoryne violescens*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 271-272, 1896.

Description.—Bulbs resemble those of *L. odorata*; leaves linear, narrow, 40 to 45 mm. wide; umbel about 6-flowered; scape 45 mm. long; spathe-valves narrow and as long as the pedicels; pedicels 20 to 30 mm. long; tube of the perianth 10 mm. long, sometimes dark colored; lobes 24 mm. long and 6 mm. wide, white, tinged with violet.

Notes.—This species was first collected in Colina, Chile, October 1887. The narrow shape of the lobes of the perianth distinguishes this species. It approaches *L. oxypetala*.

10. *Leucocoryne narcissoides*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 271, 1896.

Description.—Scape 2-flowered; limb of the perianth lanceolate, much longer than the tube; staminodes cylindrical, short, following hardly the middle of the length of the tube.

Notes.—Reported from Cachinal de la Sierra, Chile. 26° 4' lat. at 2000 meter elevation.

11. *Leucocoryne appendiculata*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 270-271, 1896.

Description.—Bulbs resemble those of *L. ixioides*; leaves *linear*, 3 mm. wide, much shorter than the scape; scape 20 cm. long, plump; spathe 35 mm. long, green, membranous toward the apex; tube of the perianth 13 mm. long; lobes 26 mm. long, usually however, 23 mm. long and 10 mm. wide; staminodes 7 mm. long, their appendix being 1 mm. in length.

Notes.—This species was first collected in Caldera a Paulo Ortega, Chile.

12. *Leucocoryne oxypetala*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 270, 1896.

Description.—Spathe reflexed; umbel 3 to 6-flowered; pedicels about 22 mm. long; tube of the perianth 8 mm. long; lobes of the perianth narrow, acuminate, 15 mm. long and 5 mm. wide; sterile stamens (staminodes) 4 mm. long, laciniate with an attenuate base.

Note.—First found near Pabellon, Capiapo, Chile by Francisco San Roman, Caldera. Philippi mentions that the lobes of the perianth have a very unique shape.

13. *Leucocoryne pauciflora*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 269-270, 1896.

Description.—Bulb covered with reddish scales like those of *L. ixioides*; Leaves narrow, linear; inflorescence 23 cm. high, 3-flowered; pedicels short, 10 mm. long; spathe 23 mm. long; tube of the perianth 9 mm. long; lobes ovate-lanceolate, 10 mm. long; staminodes pale yellow; capsule 16 mm. long and 5 mm. wide.

Notes.—This species was collected at Montenegro, Chile by Aug. Borchers, 1884. The fruits are much smaller than are those of *L. ixioides*.

14. *Leucocoryna montana*, R. A. Philippi, Plantas Nuevas Chilenas, Ann. Univ. Chile. 269, 1896.

Description.—Leaves linear, narrow, 3 mm. wide; scape 4-flowered, 20 cm. high or less; pedicels elongate, 55 mm. long; spathe 28 mm. long; perianth 3 cm. in diameter; sterile stamens (staminodes) yellow, narrow.

Notes.—was first reported from Campana de Quillota, Chile by Aug. Borchers in 1884. *L. montana* differs from *L. ixioides* by its narrow tube and the much narrower lobes of the perianth.

2. THE GENUS TRISTAGMA

The Genus *Tristagma* was mentioned for the first time in a small publication of 30 pages by Ed. Poeppig,¹ containing the descriptions of a number of new genera and species that were obtained from Chile. *T. nivale*, Poeppig, was the only species of this genus that was described in this publication and is therefore the type with which all the other species have to be compared. Later on there appeared the name of *Stemmatium* given by Rudulfo A. Philippi² as a “nuevo jenero de las Liliaceas.” He gave only one species, namely *S. narcissoides*, Phil. He believed that this

¹ **Eduardo Poeppig.** Fragmentum synopseos plantarum phanerogamarum ab auctore annis MDCCCXXVII ad MDCCCXXIX in Chile lectarum. 8-9 Lipsiae, 1833.

² **Rudulfo A. Philippi.** Descripcion de las plantas nuevas incorporadas ultimamanta en al herbaria chileno, por el doctor don Rudulfo A. Philippi. Anales de la Universidad de Chile. 43: 551-552, 1873.

species is closely allied to *Leucocoryne*. A few years later the name of *Stephanolirion*, Baker³ was proposed with *St. narcissoides*, Baker, as the only species. He described the genus and the species in considerable detail. However, he did not mention *Stammattium narcissoides*, Phillippi. Modern works, like that of K. Krause, Liliaceae, in Engler and Prantl, Die Naturlichen Pflanzenfamilien 2 ed. vol. 15 a: 324, 1930, consider *Stammattium* and *Stephanolirion* as synonyms of *Tristagma*. Whether Baker knew anything about the publication of Phillippi is not certain. It is of interest to note the description of the fruit. Phillippi describes the fruit as "fructus capsula ovata, in parte superiore loculicide deshiscens." Baker on the other hand had not seen the fruit, indicating "Fruit not yet known." It may be purely accidental that both authors had given to this plant the species-name of *Narcissoides*.

Genus TRISTAGMA Poeppig

Poepp. Fragm. Synops. Phaner. Chile. 8, 1833; syn. *Stemmatium* Phil. Anal. Univ. Chile. 43: 551, 1873; *Stephanolirion* Baker Gard. Chron. new ser. III; 234, 1875.

Bulbous plants; leaves few, narrow, linear; scape simple and short; inflorescence an umbel, composed of but a few flowers, enclosed in membranous bracts; perianth with a cylindric tube and narrow extended lobes; stamens 6, enclosed in the perianth-tube; filaments very short, the anthers long; ovary superior, ovate, 3-celled, many ovules in each cell; style short; fruit a capsule with many seeds.

The species of the Genus *Tristagma*, all native to Chile, are described below.

DESCRIPTION OF SPECIES

1. *Tristagma nivale*, Poepp. Fragm. Synops. Phaner. Chile. 9, 1833.

Description.—Bulb tunicate, ovate, attenuate; outer scales membranous; leaves linear, narrow, obtuse, bright green; scape simple; spathe-valves bipartitate; pedicels unequal; flowers scentless, united into an umbel; perianth tube cylindrical; filaments short with long anthers; style simple, stigma obtuse; ovary ovate; capsule 3-celled, many seeded.

Notes.—Native to Southern Chile, Andean Region.

2. *Tristagma narcissoides*, (Phil.) Benth. et Hook., Gen. Plant. 3 pars 2: 798-799, 1883; *Stemmatium narcissoides*, Phil., Ann. Univ. Chile. 43: 551-552, 1873; *Stephanolirion narcissoides*, Baker, Gard. Chron. Ser. III: 234, 1875.

Description.—Bulb globose, about 2.5 cm. in diameter, covered by brown membranous scales; leaves 3 to 4, appearing at the same time with the flowers, erect, 30 cm. long, 5 mm. wide, glabrous, narrow linear, acuminate; scape slender, terete, purple, 30 cm. long; umbel 5 to 6 flowered; spathe-valves two, 24 to 30 mm. long, linear, acuminate, membranous; pedicles slender 6 to 12 mm. long; perianth hypocrateriform,

³ J. G. Baker. *Stephanolirion*, Baker, genus novum. Gardener's Chronicle. Ser. III, 234, 1875.

tube about 12 mm. long, cylindrical, dingy white; segments 6, ob-lanceolate, subacute, 16-18 mm. long, 6 mm. wide, pure white with a slender, two-nerved, greenish keel; corona erect from the throat of the tube, clearly orange, 2mm. deep; stamens 6, the small sessile oblong, yellow anthers grouped tightly in two sets of three each in the upper half of the tube; pistil not reaching more than half way into the tube; ovary 3-celled, cylindrical with several horizontal ovules in each cell; style erect, considerably shorter than the ovary; stigma capitate; fruit an ovate capsule.

Notes.—Philippi records his species from Carrizal-Baja, Province of Atamaca, Chile where it was found by Tomas King. Baker notes that “this interesting novelty was imported by Messrs. Veitch from Chile and flowered in their London garden last September (1874).” He also states that its general appearance at a first glance is most like that of the slender varieties of *Narcissus Tazetta* with a white limb and orange crown. Benthams and Hooker brought this species under *Tristagma*.

3. *Tristagma dimorphopetala*, C. Gay, Flora Chil. 6: 126, 1853; Atlas t. 69 bis.; *Leucocoryne Gayi*, Baker, Journ. Linn. Soc. 11: 375, 1871.

Description.—Bulb unknown; leaves linear, 12 to 18 cm. long and 3 mm. wide; scape fragile, fistulose, about as long as the leaves, 6- to 8-flowered; spathe-valves lanceolate, attenuate, 24 to 30 mm. long; pedicels variable in length on the same umbel, from 2 to 7 cm. long; perianth 10 to 12 mm. long; segments about half as long as the tube, oblong to oval, 5 to 6 mm. long; the three largest stamens 8 mm., the three shortest, 5 to 6 mm. long; ovary oval, truncate, 3 to 4 mm. long and about $\frac{3}{4}$ mm. wide, slightly grooved, 3-celled, terminated by an obtuse stigma; capsule 8 to 12 mm. long and 5 to 7 mm. wide.

Notes.—Gay found this species among arid hills of Arquero near Coquimbo, Chile.

3. THE GENUS STEINMANNIA

The Genus *Steinmannia* was founded by Philippi¹ in 1884, in honor to a certain Steinmann. Very few data could be found about this monotypic genus.

Genus STEINMANNIA Philippi

Phil. f. in Anal. Univ. Chile, 10. 1884; Krause, Liliaceae, in Engler and Prantl, Die Natürlichen Pflanzenfamilien. 15a: 324, 1930.

Bulbous plants; perianth tubular to campanulate; the six perianth lobes longish, blunt; stamens becoming free at upper half of perianth tube; filaments thread-like; anthers small, roundish to oval; ovary elongated, 3-celled, many ovules in each cell; style round, stigma simple, shield-shaped; fruit a capsule, longish with black warty seeds.

1. *Steinmannia graminifolia*, Phil., in Anal. Univ. Chile, 10, 1884.

¹ F. Philippi. Anales de la Universidad de Chile. 10, 1884.

Small bulbous plants with narrow, linear leaves; scape simple thin and short; flowers greenish-yellow, surrounded by a thin membranous bract.

The description of this species is otherwise identical with that given above for the Genus.

Notes.—This species grows between rocks, and was first reported by Philippi from Santiago, Chile.

4. THE GENUS NOTHOSCORDUM (SOUTH AMERICAN PART)

The species of this genus are distributed in North and South America. Some have been reported as having escaped along the Mediterranean and other parts of the Old World. *Nothoscordum* is closely allied to *Milla* and to *Brodiaea*. In this contribution only the two species from South America need to be considered, namely *N. aureum* and *N. hirtellum*.

1. *Nothoscordum hirtellum* (Kunth) Baker, Gard. Chron. III. 20: 459. 1896; *Triteleia hirtella* Kunth, Enum. Plant. 4: 456, 1843; *Milla hirtella* Baker Journ. Linn. Soc. 11: 385, 1871.

Description.—Bulb subglobose to ovoid; leaves 10 to 18 cm. in length, filiform, about 1 mm. wide; scape 15 to 18 cm. in length; perianth yellow; segments elliptic; tube campanulate; stamens inserted in the tube; anthers subulate; ovary sessile; style filiform.

Notes.—Montevideo, Gaudichaud.

2. *Nothoscordum aureum* (Lindl.) Johnston & Parodie, Rev., Fac. Agron. Vet. Buenos Aires 7: 182, 1930; *Triteleia aurea* Lindl. Bot. Reg. 27: Misc. 76, 1841; *Milla aurea* Baker Journ. Linn. Soc. 11: 386, 1871; *Brodiaea aurea* Macloski. Rep. Princeton Univ. Exped. Patag. 81: 304, 1903/06.

Description.—Bulb round, 6 to 10 mm. in diameter, tunicate, membranous, whitish; leaves 6 to 8, cavnose-herbaceous, filiform, 16 to 20 cm. in length; spathe-valves 2, lanceolate, connate at the base, 6 to 8 mm. long; umbels 2 to 6 flowered; pedicels 16 to 22 mm. long; perianth 8-12 mm. long; segments oblong-spathulate, subobtuse, greenish striped; tube short; stamens biseriate; filaments 2 to 3 mm. long; ovary sessile; style 2 mm. in length; seeds 5 to 6 in a locule.

Notes.—Bonaria, Gillies; Montevideo, Hibert; Entre Rios, Tweedie.

5. THE GENUS TRITELEIA (SOUTH AMERICAN PART)

In the present account, only the South American representatives of the genus will be considered. The species of this genus have often been associated with *Brodiaea* and *Milla*. Krause in his Liliaceae, in Engler and Prantl, Die Natuerlichen Pflanzenfamilien, ed. 2. 15a: 323-324, 1930, considers *Triteleia*, together with *Callipora*, as subgenera of the genus *Brodiaea*. Baker, in Journ. Linn. Soc. 11: 378-387, 1871, puts them under the generic name *Milla*. Only three species of South American origin need to be considered here.

1. *Triteleia conspicua* Baker in Saund. Refug. Bot. t. 43; *Milla uniflora* R. Grah. in Edinb. Nat. Phil. Journ. 174, 1833.—Hook. Bot. Mag. t. 3327.

Description.—Bulb ovate; leaves 30 cm. long, $\frac{1}{2}$ line wide, glaucous, linear, upper surface concave; scape 10 to 12 cm. long, erect, glabrous, slightly compressed; spathes bidentate, valves connivent, somewhat unequal in length; pedicel longer than the spathe; perianth 2.5 to 3.5 cm. in diameter; marked from the base of the tube to the apex of the segments with six dark lines, purplish-green below and lilac in front; segments of the limb longer than the tube, spreading, ovate, acute; stamens unequal in length adhering to the tube; anthers yellow, oblong, bifid; stigma capitate, small, white, pubescent; style grooved; ovary oblong, six-furrowed, capsule clavate, depressed at the apex.

Notes.—This species was discovered by Dr. Gillies in 1820 on river banks near Buenos Ayres, Argentina and was marked “*Milla* Nov. Sp.” Later on Mr. Neill received bulbs, in June 1832, that were collected by Mr. Tweedie from the same locality. They flowered at Canon Hills, England at the end of 1833 and again in March 1834.

2. *Triteleia coerulea* (Scheele) Andrè; *Milla coerulea* Scheele in *Linnaea* 25: 260, 1852.

Description.—Bulb globose-ovate, tunicate, membranous; leaves 4, erect, fistulose, $\frac{1}{2}$ line wide; scape erect, fistulose, glabrous, furcate, 2-flowered, seldom 1- or 3-flowered; spathes bifurcate; pedicels erect; perianth funnel-shaped; tube elongate, oblong-campanulate; ovary obovate; style filiform.

Note.—Growing in dry prairies, probably in Argentina and Chile.

3. *Triteleia graminifolia* Presl, Bot. Bemerk. 116, 1844.

No description of this species could be found. Presl states: “*Bulbocadium graminifolium* Bert. in herb. chil. in it.—est *Triteleia graminifolia* Presl., [Abh. Boehm. Ges. Wiss. V. 3: 116, 1845]—Eandem stirpem legit in Chile clar. Cuming.”

6. THE GENUS BRODIAEA (SOUTH AMERICAN PART)

No attempt will be made to present here a general description of the genus *Brodiaea* because only the South American representatives are considered. It is worth while to mention that Baker,¹ in 1896, described the South American species of *Brodiaea*. At that time, many of these species and those of allied genera were exhibited by Messrs. Wallace & Co., of Colchester, England. It is also of interest to note that Baker² monographed in 1871 a number of *Brodiaea* species that were grouped by older authors—Cavanilles, Smith, Lindley and Kunth—with *Milla*, *Brodiaea*, *Triteleia*, *Callipora*, *Hesperoscordum*, *Dichelostemma* and *Senbertia*. He merged all of these genera into two, namely *Brodiaea*, characterized by having three of the six stamens imperfect, and *Milla*, in which all six stamens are uniform and fertile. Later on, in 1879, Sereno Watson, who worked with this group, presented a different classification. He merged the above mentioned genera into *Brodiaea*, exclusive of *Milla*, which he considered as monotypic. This classification

¹ Baker, J. G. The genus *Brodiaea* and its Allies. Gard. Chron. Ser. 3.20; 213-214, 238-239, 459, 687, 1896.

² Baker, J. G. A Revision of the Genera and Species of Herbaceous Capsular gamophyllous Liliaceae. Journ. Linn. Soc. 11:249-436, 1871.

was also followed by Bentham in his *Genera Plantarum*. It should be especially emphasized however that Watson considered the North American species only, which have recently been adequately treated by Hoover. In the present enumeration no attempt will be made to clear up the nomenclature of the South American species which is a greater task than could be undertaken during the war years.

DESCRIPTION OF THE SPECIES

1. *Brodiaea sessiliflora* Baker in Gard. Chron. Ser. 3. 20: 459, 1896.—*Milla sessiliflora* Baker in Journ. Linn. Soc. 11: 382, 1871; *Triteleia sessilis* Philippi, Linnaea 29: 72, 1857-8; *Brodiaea sessilis* (Philippi) Meigen in Engler's Bot. Jalub. 17: 225, 1893.

Description.—Bulb ovoid, 7 to 10 mm. in diameter; membranous, tunicate; leaves 4 to 5, carnose, herbaceous, filiform; scape 25 to 35 mm. long; spathe valves 2, linear; flowers solitary, white, 20 to 24 mm. long; segments ascending, lanceolate; stamens about the middle of the tube; filaments filiform; anthers oblong; ovary sessile; style 12 to 15 mm. long.

Note.—Native to Chile.

2. *Brodiaea Poeppigiana* (Gay) Kurtz, Bol. Acad. Noc. Cienc. Córdoba 13: 199, 202, 1893; Gard. Chron. Ser. 3.20: 459, 1896.—*Milla Poeppigiana* Baker in Journ. Linn. Soc. 11: 383, 1871.—*Triteleia Poeppigiana* C. Gay in Flora Chil. 6: 117, 1853.

Description.—Bulb oval; leaves 5 to 7, carnose, herbaceous 16 to 24 cm. in length, 6 to 8 mm. wide; scape 2 to 3, flaccid; spathe valves 2 (seldom 3 or 4), lanceolate, 2 cm. long, connate at the base; umbels 4- to 8-flowered; pedicels 28 to 35 mm. long; perianth funnel-shaped, pale lilac, 20 to 24 mm. long; segments oblong-spathulate; tube funnelform, 5 mm. in diameter; filaments filiform, 5 mm. long; ovary sessile; style thread-like, 5 mm. in length.

Notes.—Gay dedicated this species to Poeppig who did much work on the flora of Chile. Native to Chile.

3. *Brodiaea patagonica* Baker in Gard. Chron. Ser. 3. 20: 459, 1896. *Triteleia patagonica* Baker. *Milla patagonica* Baker in Journ. Linn. Soc. 11: 383, 1871.

Description.—Leaves 4 to 5, filiform, 12 to 20 cm. in length; scape 1-flowered, 8 to 15 cm. long; spathe valves 2, lanceolate, erect, 20 to 22 mm. long, connate at the base; pedicels 14 to 22 mm. long; perianth 22 to 28 mm. in length, light lilac; segments lanceolate, acuminate, erect; tube funnelform; stamens biserate; filaments filiform, 8 to 10 mm. long; ovary sessile; style 7 to 8 mm. long.

Note.—This species resembles *B. uniflora*, from which it differs by its filiform leaves, and its segments, that are lanceolate, acuminate. It has been reported from Patagonia by Capt. Middleton.

An earlier description of the species (Journ. Linn. Soc. 11: 383, 1871) is given below:

Description.—Bulb, accordingly to the description of Baker, unknown; leaves filiform, moderately firm, 12 to 20 cm. in length; scape

1-flowered, 8 to 15 cm. long; spathe valves 2, lanceolate, erect 16 to 18 mm. long, connate at the base; pedicels 10 to 15 mm. long; perianth 12 to 15 mm. long, pale violet; segments lanceolate, acuminate erect; tube narrow funnelshaped; stamens in the tube biseriate; filaments filiform 4 to 6 mm. long; ovary sessile; style 5 mm. in length.

4. *Brodiaea subbiflora* (Colla) Baker in Gard. Chron. Ser. 3. 20: 459, 1896.—*Milla subbiflora* Baker in Journ. Linn. Soc. 11: 385, 1871.—*Allium subbiflorum* Colla in Act. Taur. 39: 13, t. 52. *Triteleia Berteri* Kunth, Enum. Plant. 4: 467. C. Gay, Flora Chil. 6: 116, 1853.

Description.—Bulb ovoid, 10 to 14 mm. in diameter, membranous, tunicate, leaves 4 to 6, firm, 1 to 3 cm. long, 1 to 1½ mm. wide; scape ½ to 1 cm. in length, one or two-flowered; spathe 2, lanceolate, 10 to 12 mm. long connate at the base; pedicels 2 to 5 mm. long; perianth funnel-shaped, white, 10 to 14 mm. long; segments oblong-spathulate, subacute, distinctly brown-carinate; tube campanulate; stamens biserate; filaments filiform, 4 mm. long; ovary sessile; style 2 mm. long.

Note.—Gay reported this species from the hills near Valparaíso, Chile. Bridges nr. 342.

5. *Brodiaea Sellowiana* (Kunth) Baker, in Gard. Chron. Ser. 3, 20: 459, 1896. *Triteleia Sellowiana* Kunth, in Enum. Plant. 4: 466, 1843. *Milla Sellowiana* Baker, in Jour. Linn. Soc. 11: 383, 1871.

Description.—Bulbs globose or globoid, membranous, tunicate, 10 to 15 mm. in diameter; leaves 6 to 12, firm, 1 to 2 cm. long, 1½ to 3 mm. wide; scape, 1 to 3 in number, 2 to 4 cm. long; flowers solitary; pedicels 4 to 8 mm. long; spathe-valves 2, lanceolate, 10 to 15 mm. long, connate at the base; perianth 20 to 24 mm. long, yellow; segments oblong-spathulate, purplish to carinate, 6 to 10 mm. wide; tube funnelshaped; stamens inserted in the tube; filaments filiform, 5 to 7 mm. long; ovary sessile; style 7 mm. long.

Note.—"Brasilia meridionalis et Montevideo, Sello nr. 3664; Gibert nr. 512."

6. *Brodiaea nivalis* (Poeppig) Baker (Macloskie ?) in Gard. Chron. Ser. 3. 20: 459, 1896.—*Milla nivalis* Baker, in Journ. Linn. Soc. 11: 383, 1871.—*Tristigma nivalis* Poeppig, in Nov. Gen. 2: 28, t. 140, 18—C. Gay. Flora Chil. 6: 125, 1853.

Description.—Bulb ovoid, membranous, tunicate; leaves 5 to 6, linear, obtuse, carnose-herbaceous, much broader at the base, bright green, 12 to 18 cm. long, 4 mm. wide; scape subequal to the leaves; spathe valves 2, lanceolate, 2 cm. in length, connate at the base; umbels 2 to 3-flowered; pedicels 7 to 32 mm. long, irregular in length; perianth funnel-shaped, 20 to 24 mm. long; segments linear, green, carnose, acute; tube cylindric, 1½ mm. wide; anthers distinctly biseriate, sessile; ovary sessile; style filiform, 2 mm. thick.

Notes.—Poeppig described this species from a specimen found in the Cordilleras of Antuco, Chile.

7. *Brodiaea setacea* Baker in Gard. Chron. Ser. 3. 20: 459, 1896.—*Milla setacea* Baker in Journ. Linn. Soc. 11: 385, 1871.

Description.—Bulb ovoid, 8 to 10 mm. thick, membranous, tunicate; leaves 5 to 6; 6 to 10 cm. in length, setaceous, firm; scape filiform, glabrous, 4 to 6 cm. long, 1-flowered; spathe valves 2, linear, 8 to 10 mm. long, connate at the base; pedicels 4 to 5 mm. long; perianth funnel-shaped, white, 10 to 12 mm. long tenate; segments oblong-spathulate, subacute, light brown; tube campanulate; stamens inserted in the tube, biseriate; filaments filiform, 4 to 5 mm. long; ovary sessile, style filiform, 5 mm. long.

Note.—This species was first reported from Tucuman, Argentina.

8. *Brodiaea Leichtlini* (Baker) Nichols, Gard. Dict. 4: 93. 1887; Gard. Chron. Ser. 2 20: 459, 1896; *Milla Leichtlini*, Baker in Bot. Mag. t 6236; Gard. Chron. 1875: 234; *B. brevipes* (Kunth) Baker Gard. Chron. Ser. 2. 20, 1896. *Milla brevipes* Baker in Journ. Linn. Soc. 11: 386, 1871.—*Triteleia brevipes* Kunze Linnaea 20: 9, 1847.

Description.—Leaves 8 to 18 cm. in length, 3 mm. wide; scape shorter than the leaves; spathe valves 2, connate at the base, 14 mm. long; umbel 3-flowered; pedicels about 3 mm. long; perianth white, 12 to 14 mm. long; segments lanceolate, brown-carinate; stamens biseriate; filaments filiform, complanate; ovary sessile.

Notes.—Reported from Chile.

9. *Brodiaea violacea* (Kunth) Baker Gard. Chron. Ser. 2. 20: 459, 1896. *Milla violacea* Baker Journ. Bot. 12: 5, 1874. *Triteleia violacea* Kunth. Enum. Plant. 4: 468, 1843.

Description.—Leaves 5 to 6, linear, glabrous, carnose-herbaceous, 6 to 10 cm. long, 2 to 4 mm. wide; scape debile; spathe valves 2, lanceolate, 12 to 25 cm. long; perianth violet, funnel-shaped; segments oblong-lanceolate, 6 mm. wide; tube campanulate; stamens in the tube biseriate, filaments linear, 6 mm. long; style filiform, 6 mm. long.

Notes.—Chile, Bertero nr. 290. in Herb. Candollei. Baker states: "On view of type specimens I find this is distinct from *bivalvis*, to which I joined it, though very nearly allied." It has a larger flower with a longer style and narrower filaments.

10. *Brodiaea Speggazinii* Macloskie Rep. Princeton Univ. Exped. Patagonia. 1896-1899. 8: 305, 1903/06. *B. patagonica* Speg. non Baker.

Description.—Bulb ovate; leaves synanthic, obtuse, narrow-linear, green to violetish; scape slightly longer than the leaves, erect, slender, glabrous, 1-flowered; spathe valves 2, perianth subtubular; segments white, marked with green line, linear, acute of equal length as the tube; pedicels half as long as the flower.

Notes.—Common Rio Sta. Cruz, and Golfo de San Jorge, Patagonia.

11. *Brodiaea porrifolia* (Poepp.) Meigen, in Engler's Bot. Jahrb. 17: 225. 1893; *Triteleia porrifolia* Poepp. Fragm. Synop. Phan. Chile 10, 1833; Kunth, Enum. Plant. 4: 468, 1843.

Description.—Bulb globose; leaves narrow, carnose; scape 3- to 5-flowered; spathe valves narrow, laciniate; flowers white-violet; segments lanceolate; obtuse, 1-veined, tube campanulate; stamens inserted at the base of the tube; filaments subulate; anthers oblong, emarginate, 2-lobed

at the base; ovary sessile, ovate-oblong, 3-celled; ovules about 10 in each cell, amphitropous; style longer than the ovary; stigma 3-lobed, recurvate.

Notes.—Reported from Chile.

12. *Brodiaea Luzula* (Speg.) Macloskie in Rep. Princeton Univ. Exped. Patag. 1896-1899. 8: 305, 1903/06. *Luzula patagonica* Speg. in Plant. Pat. Austr. nr. 366.

Description.—Stem fistulose, several leaves at the base, subglabrous, acute; scape erect; inflorescence short and thick, rather remote; segments of the perianth 3 external, lanceolate-awned, 3 internal, obtusely acute; stamens antheriferous; fruit ovate, 3-sided. var. *angustiloba* (Speg.) Macloskie is larger than the species, the pedicels are as long or longer than the bracts; perianth is larger; tube is whitish with 5 green stripes; segments are narrower-linear without white margins.

Notes.—This species is distributed from Rio Chubut to Rio Gallegos, Patagonia.

13. *Brodiaea Gaudichaudiana* (Kunth) Fuentes, Bol. Mus. Nac. Chile 12: 110. 1929; *Triteleia Gaudichaudiana* Kunth, Enum. Plant 4: 467, 1843.

Description.—Bulb ovate, tunicate; leaves 3 to 6, linear, glabrous; scape 5 cm. long, glabrous; spathe 2-valved; valves lanceolate, acuminate; umbels 2 to 3-flowered; pedicels 8 to 12 mm. long; flowers erect, like those of *Gagea pratensis* (“magnitudine floris Gageae pratensis”); segments oblong, rotundate-obtuse, 1-veined, equal; stamens inserted in the perianth; ovary sessile, obovate, three-sided, with many ovules; style erect; stigma three-lobed.

Notes.—Reported from the environs of Valparaiso, Chile.

14. *Brodiaea bivalvis* (Lindl.) Meigen. Bot. Jahrb. 17: 224, 1893. *Milla bivalvis* Baker Journ. Linn. Soc. 11: 386, 1871.—*Triteleia bivalvis* Lindl. Bot. Reg. sub. t. 1293. Kunth. Enum. Plant. 4: 468, 1843. C. Gay Flor. Chil. 6: 117, 1853.

Description.—Bulb ovoid, 12 to 20 mm. wide, membranous, tunicate; leaves 4 to 6, carnosae, herbaceous 12 to 20 cm. long and 2 to 3 mm. wide; spathe valves 2, linear-lanceolate, connate at the base, 8 to 12 mm. long; umbels 2 to 4 flowered; pedicels flaccid, 10 to 18 mm. long; perianth funnel-shaped, white or white-violet, 10 to 14 mm. long; segments oblong-spathulate, distinct brown cariate; tube campanulate; stamens biseriate; filaments 3 mm. long; ovary sessile; style filiform, 2 to 2.5 mm. in length; seeds 5 to 6 in each loculus.

Notes.—Chile, Beechey, Cuming nr. 651.

15. *Brodiaea Berteri* (Kunth) Fuentes, Bol. Mus. Nac. Chile 12: 110. 1929; *Triteleia Berteri* Kunth, Enum. Plant. 4: 467, 1843. *Allum striatello proximum* Bert. in herb. un. item. no. 1802.

Description.—Bulb ovate; leaves narrow linear, obtuse, canaliculate; scape 5 to 7 cm., 1-flowered, erect, glabrous; spathe two-valved; valves lanceolate-linear; lobes of the perianth oblong, acute, one-veined, subequal.

Notes.—Valparaiso, Gaudich, Bertero.

16. *Brodiaea Ameghioni* Speg. in Rev. Agron. La Plata 575, 1897. *Tristagma Ameghioni* Speg.

Description.—Bulb ovate, 35 to 50 mm. thick, tunicate; leaves 5 to 8, linear, 8 to 12 cm. long and 2 to 3 mm. wide; scape 1 to 2-flowered, erect, slender; scape valves short, seldom of the same length, 50 to 80 mm. long, 0.8 mm. wide, terete, glabrous, linear-lanceolate; perianth tubulose; tube cylindric, 12 mm. long and 2 mm. wide, greenish-white; segments linear, 7 to 9 mm. long and 0.5 to 0.8 mm. wide, obtuse or short acute; filaments slender, pale, glabrous; ovary ovate, 3 mm. long and 1.5 mm. wide, glabrous, green; style 3 mm. long.

Notes.—In dry sandy fields, Golfo de San Jorge, February 1896. Has been reported by Carolo Spegazzini from Argentina.

17. *Brodiaea circinata* Sandwith in: Hooker's Icones Plantarum. Pl. 3350, 1937.

Description.—Perennial herb; bulb oblong to ovoid, about 2.5 cm. in length, and 1.5 cm. in diameter; membranes whitish-hyline, striate; sheathe 7.5 cm. in length; leaves 3 to 4, glaucous, rolled up toward the apex, 10 to 16 cm. long, about 6 to 8 mm. wide; scapes one or two, purplish, 7.5 to 13 cm. long and 2 mm. thick; spathe-valves 2, connate at the base, white, membranous, with violet veins, 1.8 to 2.1 cm. in length and 7 mm. wide, obtuse, erect, reaching above the tube of the perianth; flowers solitary, sessile, white, erect; tube of the perianth narrow funnel to bell-shaped, 1.2 to 1.4 cm. long and 6 mm. wide at the top, violet, vittate; segments spatulate, rounded at the top, cuculate, emarginate, 1.7 to 1.8 cm. long and 6 to 8 mm. wide, white, membranous; stamens 6, about 8 mm. long, occurring above the tube; filaments unequal, alternate, about 8 to 10 mm. long; anthers oblong, 2 to 3.75 mm. long; ovary ovoid to ellipsoid, 5 mm. long and 2 to 3 mm. in diameter; style well pronounced ending in a faintly three-lobed stigma. Fruit unknown.

Notes.—This species is known from very high altitude on the eastern slopes of the principal chain of the Andes, including Gobernación del Neuquen; Cerro Colohuincul near San Martin de los Andes at 1800 to 2100 meter in Argentina. Plants have been found near the snow-line. Sandwith mentions that *B. circinata* is apparently related to *B. patagonica* (Baker) Baker, a species with a wide distribution throughout Patagonia and occurs in the region of Neuquen at low level up to 1650 meter elevation.

18. *Brodiaea Felipponei* (Beauvd.) Herter in: Estudios Botánicos en la Region Uruguaya. IV Florula Uruguayensis, Plantae Vascularis. 47, 1930. *Nothoscordium Felipponei* Beauverd in: V Plantes nouvelles de l'Uruguay. Bull. Soc. Bot. Genève. 13: 7, 267, 1922.

Description.—Bulb ovate to elongate, about 2 cm. long and 1 cm. in diameter, white tunic 1 cm. long; leaves glabrous, unequal, 3 to 8 cm. long and 1 to 2.5 mm. wide, recurved, base dilate, narrow lanceolate; scape glabrous, erect, 1.5 to 3 cm. long; spathe-valves 1 to 1.2 cm. long, white, scariose, 2 to 4 veined; perianth with short pedicel which is about 6 mm. long, erect, gold-yellow; filaments yellow, inserted on the segments of the perianth, 6.5 mm. long; anthers yellow, about 2.5 mm. long; ovary oboconic, 3 mm. long; style erect about 4 mm. long; stigma slightly three-lobed.

Notes.—This species is related to *Brodiaea uniflora* from which it differs because of its beautiful golden-yellow colored flowers, striped with purple. G. Beauverd observes: “*Triteleia Sellowiana* Kunth. ?” teste cl. Osten, exsicc. no. 3620 in herb. Boissier: “Per flavo, tepalis, nitidis dorso atro purpureo-vittatis vel pectis; tepala basi connata, folia canaliculata dorso haud carinata.—Uruguay, Dep. Montevideo, “Cerro in saxosis 31 Jule 1898; leg. Cornelius Osten “non *Nothoscordon Sellowianum* Kunth. in Enum. plant. IV (1843) 457 et seq. ! - “Cuchilla de Pereira, Montevideo “mense Junii 1920, leg. cl. Dr. F. Fileppone cui hoc *Nothoscordium* insignum dictatum est (exsicc. no. 3493).”

19. *Brodiaea Tweediana* (Baker) Hicken, Apuntes Hist. Nat. Buenos Aires 2: 68, 1910; *Milla uniflora* var. *Tweediana* Baker, Journ. Linn. Soc. 11: 382-383, 1871.—*Milla Tweediana* Griseb. in Symbolae ad Floram Argentinam in Abhandl. König. Gesellsch. Wiss. Goettingen. 24: 318, 1879.

Description.—Much smaller than *B. uniflora*; leaves 1 mm. wide; scape is 4 to 7 cm. long; pedicels 7 cm. long; perianth 10 to 12 mm. in diameter; segments oblong-spathulate.

Notes.—Bonaria, Tweedie.

2. *Brodiaea vittata* (Grieseb.) Baker Gard. Chron. Ser. 3.20: 459, 1896.—*Milla vittata* Griseb. Symbolae ad Floram Argentinam in Abhandl. Konigl. Gsellsch. Wiss. Goettingen. 24: 318-319, 1879.

Description.—Bulb subglobose; scape one-flowered; pedicels 3 to 4 mm. long, not articulate; bracts connate toward the base, lanceolate to linear, erect, 6 to 8 mm. long; perianth white, tinged with red; tube funnel-shaped, 1½ mm. long.

Notes.—Reported from Concepcion in Uruguay. Accordingly to Grisebach this species is related to *B. Sellowiana* (Kunth) Baker.

21. *Brodiaea recurvifolia* Wright in Decades Kewensis. Misc. Inf. Kew. 117, 1915.

Description.—Bulb ovoid, about 1 cm. in diameter; leaves linear, obtuse, recurvate, flat, glabrous; the margin being minutely denticulate, 6 cm. long and 2.5 mm. wide; peduncles slender, 2 cm. long, one-flowered; spathe 18 mm. long, membranous, two-lobed; pedicels 1 to 3 mm. long; perianth white or yellowish; tube of the perianth 1.5 mm. long; lobes elliptic, 3 mm. long; anthers oblong, 1.5 mm. long; ovary subglobose, locules of ovary with 10 to 12 ovules; style 1.5 cm. long; stigma short, three-lobed.

Notes.—Reported from Montevideo, Arechavaleta 19, Canelan Chico, Berro nr. 5898. Wright states that this is quite a diminutive species of *Brodiaea* and has the appearance of a dwarf *Zephyranthes*. This species is supposed to be related to *B. Sellowiana* (Kunth) Baker.

22. *Brodiaea uniflora* (Lindl.) Engler in Engl. & Prantl Nat. Pflanzenfam. 2, pt. 5: 57, 1887; Baker in Gard. Chron. Ser. 3, 20: 459, 1896.—*Milla uniflora* Graham. Edinb. Nat. Phil. Journ. Dec. 1832.—Hook. Bot. Mag. t. 3327.—*Triteleia uniflora* Lindl. in Edward's Bot.

Reg. 15: pl. 1293, 1829; Kunth. Enum. Plant. 4: 466, 1843. Flor. Jard. 3. 177. *Milla bonariensis* Gillies M.SS.

Description.—Bulb ovoid, proliferous, membranous, tunicate, 12 to 20 mm. in diameter; leaves 6 to 9, 12 to 24 cm. long and 3 to 6 mm. wide, glaucous; scape one, seldom two-flowered; spathe-valves two, lanceolate, 20 to 32 mm. long, connate; pedicels 2 to 4 mm. long; perianth 20 to 40 mm. long, light lilac to white, sometimes blue; segments lanceolate-spathulate, expanding from the tube, 5 to 6 mm. wide; filaments filiform; ovary sessile; style filiform, 6 to 10 mm. long. Several garden varieties of this species are in existence.

Notes.—Native to Argentina.

23. *Brodiaea viridior* Killip in Journ. Wash. Acad. Sci. 16: 566, 1926.

Description.—Bulb globose, 1 cm. in diameter; leaves 3 to 4, narrow linear, 25 to 35 cm. in length and 5 to 12 mm. broad, almost flat; scape one- or two-flowered, erect, 20 to 30 cm. in height; spathe bivalved; bracts linear, 15 to 25 mm. long, connate toward the base, white; pedicels slender, 2 to 3 cm. in length; tube of the perianth white, green along the vein; cylindric, 8 to 12 mm. long, and 5 to 6 mm. broad; segments oblong-lanceolate, 15 to 20 mm. long and 4 to 5 mm. broad, tapering to a subcaudate apex; stamens in two groups, inserted at the throat of the tube; filaments filiform, 3 to 5 mm. in length; style 9 to 10 mm. long; ovary sessile.

Notes.—First collected by Walter Fischer (nr. 122) in the vicinity of General Roca, Rio Negro valley, Argentina, at the altitude of 250 to 360 meters, September 28, 1914. Type specimen in the U. S. National Herbarium nr. 704305. Killip states: "In Baker's key to this group of species *B. viridior* would come nearest *Brodiaea* (*Milla* of Baker) *Poeppingiana*, a Chilean plant with lilac flowers having shorter, nearly acute segments."

24. *Brodiaea gracilis* (Philippi) Fuentes, Bol. Mus. Nac. Chile 12: 110, 1929; *Brodiaea Philippiana* Baker in Gard. Chron. Ser. 3, 20: 459, 1896.—*Trileleia gracilis* A. Philippi in Description de los plantas nuevas incorporados en el herbario chileno por el doctor don Rodulf A. Philippi in Anales Univ. Chile. 550, 1873.

Description.—Bulb ovoid; leaves narrow linear, 30 cm. long and 4 mm. wide; scape slender, two-flowered; spathe valves linear, 14 mm. long; pedicels 11 mm. long; perianth 18 mm. long, length of the lobes 3 mm.; style as long as the half the length of the perianth and as long as the stamens.

Notes.—A. Philippi states that this species resembles *B. bivalvis* (Lindl.) Meigen. Reported from different parts of Chile.

NEW ALLIUM NAMES AND A DELETED SPECIES

In connection with the preparation of an article on the North American species of *Allium*, evidence was uncovered that makes necessary the following nomenclatural changes.

Allium sanbenitense* Traub, *nom. nov.

SYN.—*Allium robustum* Eastw. Leaf. West. Bot. 2: 110. 1938, non Kar. et Kir. (1841).

NOTES.—*Allium robustum* Karelin et Kirilov [Bull. Soc. Nat. Mosc. XIV: 853. 1841, non Eastwood 1938; Vvedensky, in Komarov, Flora USSR IV: 265. 1935; Herbertia 11 (1941): 205. 1946], native to Central Asia has priority by almost 100 years and the present species was therefore without a name. The name here proposed commemorates San Benito County, California, the native habitat of the species.

Allium Douglasii* Hook., var. *Tolmiei* (Baker) Traub, *comb. nov.

SYN.—*Allium Douglasii* Hook., var. β , in Fl. Bor. Amer. 2: 185. 1839; *A. Tolmiei* Baker, Bot. Mag. 102, (mentioned in connection with pl. 6227, *A. anceps* Kell.), 1876, non Coulter, 1885.

NOTES.—In connection with *A. anceps* Kell. (Bot. Mag. 102, under pl. 6227. 1876), Baker observes that there are two other species similar in habit in the same region—"A. *falcifolium* Hook. & Arn., and *A. Tolmiei* Baker MSS., the latter described as a variety of *A. Douglasii* in Hooker's Flora Boreali-Americana vol. ii., p. 185." The description given by Hooker, on which Baker apparently based his published name, records only a difference in length of the leaves with reference to the scape between the proposed species, *A. Tolmiei* Baker 1876, non Coulter 1885, and *A. Douglasii* Hooker. On biological grounds this is not a sufficient difference to warrant the elevation of var. β , of *A. Douglasii* Hooker to species rank.

After the description of *A. Douglasii*, Hooker lists "var. *a*" which apparently is the type. He then lists "var. β , foliis scapo longioribus." Since the description in Baker's MSS., has never been published, the name, *A. Tolmiei*, proposed by Baker in 1876 must be applied only to *A. Douglasii* var. β , otherwise it is a *nomen nudum*, and is again available. Baker however definitely states that his *A. Tolmiei* is described as a variety of *A. Douglasii* in Hooker's Flora Boreali-Americana vol. ii, p. 185, and we assume that he has read Hooker's text correctly. *A. Tolmiei* Baker 1876, non Coulter 1885, is then the same as *A. Douglasii* excepting that in the former the leaves are longer than the scape.

The paragraph by Hooker following the listing of vars. *a* and β of *A. Douglasii* is not as clearly written as it might be and this has caused confusion of names by later workers as indicated under the following species.

***Allium idahoense* Traub, nom. nov.**

SYN.—*Allium Tolmiei* Coulter, Bot. Rocky Mtn. Reg., 349. 1885, non Baker 1876; Index Kewensis I: 83. 1893; Howell, Fl. NW. Amer. 1 (fasc. 6): 640. 1902; Rydberg, Fl. Rocky Mts. 161. 1917; Abrams, Illus. Fl. Pac. States 1: 387. 1923.

TYPE DESCRIPTION ADAPTED FROM COULTER (1885): Bulbs ovate, not rhizomatous, membranous coats mostly without reticulation; leaves 2, broadly linear, flat and falcate, thick; scape stout, 5—10 cm. tall, much compressed and 2-winged, low and mostly shorter than the leaves; spathe 2-valved; flowers light rose-color, with a darker mid-vein; segments lanceolate, acute, gibbous at base, a half longer than the stamens; ovary very obscurely crested.

RANGE.—According to Coulter (1885), this species ranges “From the Wahsatch Mountains to southern Idaho.” This range was extended by later workers to include Eastern Oregon, Washington and southern Idaho to Utah.

NOTES.—The paragraph that follows Hooker’s description of *A. Douglasii* reads as follows, (insertions in brackets [] are the present writer’s): The flowers of this [*Allium Douglasii* Hook.] a great deal resemble the preceding [*Allium acuminatum* Hook.] in shape and colour, but the apex of the sepals is not recurved, the stamens are longer and the leaves are totally different, being more than half an inch broad, in the dry state thick and somewhat coriaceous, indicating that in the recent plant they are thick and fleshy. Mr. Douglas had marked it *A. fragrans*, but with the *fragrans* Spreng. (*A. inodorum* Gawl.) it has no sort of affinity whatever. Tab. CXCVII. Fig. 1, flower; f. 2 sepals and stamens; f. 3 pistil.” It is clear that Hooker is not contrasting varieties α and β of *A. Douglasii*, for var. β differs from the type (var. α) only in having leaves longer than the scape. Hooker is in fact contrasting *A. Douglasii* Hooker with *A. acuminatum* Hooker which precedes it in the text. An examination of the details of Hooker’s Tab. CXCVII (*A. Douglasii* Hook.) and Tab. CXCVI (*A. acuminatum* Hook.) will convince anyone that the description in the quotation from Hooker fits *A. Douglasii*, the type, and cannot therefore also serve as the list of distinguishing characters for a variety of it.

Sereno Watson (Proc. Amer. Acad. 14: 228. 1879) apparently misinterpreted Hooker, for Watson observes with reference to *A. Douglasii* Hook., that “The figure and description in Hook. Fl. Bor.-Am. refer, with the exception of the scape and the details of the flower, to his var. β , i. e. to *A. Tolmiei*, Baker.”

Coulter (1885) apparently also misinterpreted this paragraph from Hooker and erroneously read “var. β ” in place of *A. Douglasii*, and “var. α ” in place of *A. acuminatum* in the quotation from Hooker. Accordingly he used the name, *A. Tolmiei* in connection with an *Allium* species sufficiently distinct but somewhat similar to *A. Douglasii* in certain of its characteristics. This species evidently is not the *A. Tolmiei* Baker 1876, non Coulter 1885, that is identical with *A. Douglasii* var. β Hooker.

Coulter (1885) indicates that his type is also based on "*A. tribracteatum* [Torr.], Watson in Bot. King's Exped. v. 353, in part." In the Index Kewensis (I: 83. 1893), *A. Tolmiei* Coulter 1885, non Baker 1876, was reduced to the synonymy of *A. tribracteatum* Torrey ("*A. Tolmiei* Baker ex Coulter. Rocky Mt. Bot. 349. = *tribracteatum*"), but *A. Tolmiei* Coulter 1885, non Baker 1876 apparently is distinct after all for later workers have consistently identified the name "*A. Tolmiei*" with Coulter's type description, but made no reference to Coulter,—Howell (1902), Rydberg (1917) and Abrams (1923).

Rydberg (1917) placed *A. anceps* var. *aberrens* M. E. Jones under *A. Tolmiei* Coulter 1885, non Baker 1876, but no reasons are given for such a disposition which apparently is not acceptable for Morton (Herbertia 7 (1940): 71, 1941) transferred *A. anceps* var. *aberrens* M. E. Jones tentatively to the synonymy of *A. Cusickii* S. Wats.

Abrams (1923) reduced *A. platyphyllum* Tiedstrom to the synonymy of *A. Tolmiei* Coulter 1885, non Baker 1876, but Morton (Herbertia 7 (1940): 75. 1941) points out that "an examination of the type shows it [*A. platyphyllum*] to be different."

Since no valid published name is available for the present species, the name *Allium idahoense* is proposed for it. The name commemorates the State of Idaho.

Allium roguense M. E. Peck, Proc. Biol. Soc. Wash. 49: 109 1936.

[**Deleted species.**]

NOTES.—In a letter to the writer, dated Dec. 10, 1945, Prof. Morton E. Peck writes that "*A. roguense* was based on material confused by the collector, the bulb described belonging to a *Brodiaea*; the species is therefore discarded."

Beltsville, Maryland

—*Hamilton P. Traub*

SECTIONS AND SUBSECTIONS OF THE GENUS
ALLIUM IN EUROPE

F. HERMANN

[Translated from the Latin (Fedde—rep. sepc. nov. reg. veg. 46: 57-58, 1939) by Edith K. Cash, Assistant Mycologist, U. S. Bureau of Plant Industry, Beltsville, Maryland.]

Pedicels not broadened above into a disk, tepals 1-nerved, more or less equal, fruit not becoming catilaginous.

A.¹ Inner filaments broadened, flat, elongated at each side by a tooth, ovary sessile, with three nectaries covered by a prominence, ovules basal, in twos in each locule, style entire, leaves distichous, sheath surrounding the peduncle to some heightPORRUM

B. Leaves not hollow, flat, conduplicate in vernation. Type: *Allium scordoprason* L.SCORDOPRASON F. Hermann

BB. Leaves flat in vernation. Type: *Allium vineale* L.ONEOPRASON F. Hermann

AA. Filaments not dentate or inner filaments with a short tooth at the base on each side, ovary more or less sessile, without a prominence.

C. Leaves sessile, ovary scarcely tricoccous.

D. Ovary having a nectary with exterior opening in each septus, peduncle terete, inflorescence without bulbils, style entire.

E. Ovules in twos at the base of each locule.

F. Leaves distichous, flat in vernation, margins not wrapped around each other.

G. Tepals 4-6 times as long as wide, more or less keeled, greatly exceeding the stamens, leaves awl-shaped, hollow, plants caespitose. Type: *Allium schoenoprasum* L.SCHOENOPRASON

GG. Tepals as long as the stamens or shorter, bulb covered with a full coat, innovations within the sheath. Type: *Allium saxatile* M. B.OREIPRASON F. Hermann

FF. Leaves broadly channelled in vernation, each lower one in turn with margins wrapped around the following, finally flat.

H. Tepals yellowish-green (96 1a), conspicuously exceeded by the stamens, leaves distichous, sheath covering the upper peduncle to some height, innovations within the sheath. Type: *Allium obliquum* L. PETROPRASON F. Hermann

HH. Tepals conspicuously longer than the stamens, leaves spiral, surrounding the peduncle slightly at base. Type: *Allium roseum* L.RHODOPRASON F. Hermann

EE. Ovary with 4 or more central ovules in each locule, in two series, leaves spiral, convolute in vernation, flat, 0.5-7 cm. broad, long acuminate, surrounding the peduncle slightly at the base, ovary smooth. Type: *Allium nigrum* L. *Allium stripurpureum* W. K. also belong hereMELAMPRASON F. Herman

¹ [Letters of the alphabet (capitals) are used for contrasting characters in place of the miscellaneous marks used in Hermann's original.—Ed.]

DD. Ovary without nectaries in the septs.

I. Peduncle and fruit-pedicels recurved, leaves conduplicate in vernation, basal. Type: *Allium Chamaemoly* L.

CHAMAEPRASON F. Hermann

II. Peduncle and fruit-pedicels straight, leaves distichous, not conduplicate in vernation.

J. Leaves flat in vernation.

K. Leaves hollow, sheaths surrounding the peduncle to some height.

L. Spathe long-rostrate (up to 25 cm.), persisting. Type: *Allium carinatum* L. RHYNCHOPRASON F. Hermann

LL. Spathe not rostrate, leaves very narrow, channelled bulbs not seated on rhizomes. Type: *Allium melananthum* PanchitschHAEMOPRASON F. Hermann

KK. Leaves not hollow, flat, surrounding the peduncle slightly at the base, bulbs seated on a short, oblique or horizontal rhizomeRHIZIRIDEUM

M. Tepals 1-2 cm. long, about twice as long as the stamens, inflorescence nodding before anthesis, then erect. Type: *Allium narcissiflorum* Vill.

NARKISSOPRASON F. Hermann

MM. Tepals 0.4-1.6 cm. long, pistil undivided, coat scarcely reticulately fibrous. Type: *Allium angulosum* L.

ORTHOPRASON F. Hermann

JJ. Leaves convolute in vernation, broad, narrowed toward the base and apex. Type: *Allium Moly* L.

XANTHOPRASON F. Hermann

CC. Lower leaves conspicuously petiolate, ovary tricoccous, without nectaries, style entire, capsule tricoccous.

N. Peduncle terete, leaves plicate in vernation with several longitudinal folds, outer coats finally reticulately fibrous. Type: *Allium victorialis* L.NIKEPRASON F. Hermann

NN. Peduncle acute-angled, leaves in vernation with revolute margins, coat thin-membranous, diaphanous, seeds globulose. Type: *Allium ursinum* L.ARKTOPRASON F. Hermann

THE ALLIUMS OF BRITISH INDIA

SIR JOSEPH D. HOOKER

[Revised and supplemented by William T. Stearn]

[The following survey is extracted from Hooker, *Flora of British India*, vi (1892) 338-345 and describes a number of Himalayan and Sino-Himalayan species not included in the accounts of *Allium* by Boissier (1882) and Vvedensky (1935) since they do not occur in the areas covered by these authors. All the *Alliums* of British India grow in the Himalayan region. Some occur as well in Central Asia or in China and one (*A. Hookeri*) is even found in Ceylon, but most of them are confined to the Himalaya. Of these Himalayan endemics *A. sikkimense* has long been in cultivation, and there are others which deserve introduction.

Dates have been added to Hooker's citations below as well as the metric equivalents of the English measurements given in his descriptions. Descriptions of species described by Vvedensky or by Boissier are omitted.

The descriptions of *A. fasciculatum*, *A. phariense* and *A. tibeticum* which follows Hooker's account are partly translated, partly transcribed from the original descriptions published by Rendle in 1906. *A. fasciculatum* is now known from Sikkim and *A. phariense* and *A. tibeticum* may yet be found there.—*W. T. S.*]

SECT. I. SCHOENOPRASON. Bulbs free or clustered, not seated on a rootstock. Leaves and scape fistular or filiform. Stamens inserted usually much above the base of the perianth; filaments dilated and connate at the base.

* Leaves fistular.

1. *A. SEMENOVII* Regel, Enum. Pl. Semenov [1868] 126; All. Monogr. [1875] 85; Baker in Journ. of Bot. 1874, 293.

[Description: See Vvedensky no. 80; Herbertia 11 (1944): 141-152. 1946.]

Western Himalaya, alt. 8-14,000 ft., from Kashmir to Garwhal.—Distrib. Alatau and Thian-chan Mts.

[Notes.—Spelled *A. Semonovii* by Hooker but *A. Semenovii* by Regel.—*W. T. S.*]

2. *A. SCHOENOPRASUM* Linn. Sp. Pl. [1753] 301; Regel, All. Monogr. [1875] 77; Baker in Journ. Bot. 1872, 292; Boiss. Fl. Orient. v. [1882] 250; Reichb., Ic. Fl. Germ. [1848] t. 1085, *A. sibiricum* Linn. Mant. [1881] 562.

[Description: See Vvedensky no. 82; HERBERTIA 11 (1944): 141-144. 1946.]

Western Himalaya, alt. 8-11,000 ft.; from Kashmir to Kumaon.—Distrib. Westwards to the Atlantic, N. America.—Chives.

3. *A. ATROSANGUINEUM* Schrenk in Bull. Sci. Acad. Sci. Petersb. x. [1842] 355; Lebed. Fl. Ross. iv. [1852] 168; Kunth, Enum. [1843] 684; Regel, All. Monogr. [1875] 83.

[Description: see Vvedensky no. 81; *Herbertia* 11(1944): 142-143. 1946.]

Western Himalaya: Cashmir at Gilgit, Tanner.—Distrib. Turkestan. The Gilgit specimens have rather smaller flowers with more obtuse segments than the Turkestan.

[Notes.—*A. atosanguineum* Schrenk with dark red flowers, *A. Fedschenkoanum* Regel with yellow flowers and *A. monadelphum* Turcz. with rose-purple flowers are united by Vvedensky (1935) into one species under the name *A. monadelphum*, as they were by Regel himself in 1887 (*Acta Horti Petrop.* x. 307) and by Lipsky in 1900 (*Acta Horti Petrop.* XVIII. iii). All possess rhizomes. The Gilgit specimens mentioned by Hooker may belong to another species. —W. T. S.]

4. *A. FEDSCHENKOANUM* Regel, All. Monogr. [1875] 82.

[Description: see Vvedensky no. 81; *Herbertia* 11 (1944): 142-143. 1946.]

Western Himalaya; Kashmir, at Barzil, alt. 12,000 ft., Clarke.—Distrib. Turkestan.

** Leaves filiform.

5. *A. RUBELLUM* M. Bieberstein, Fl. Taur. Cauc. i. [1808] 264; Regel, All. Monogr. [1875] 106; Fl. Turkest. [1876] t. 10. f. 9; G. Don, Monogr. All. [1827] 36; Kunth, Enum. iv. [1843] 399; Boiss., Fl. Orient. v. [1882] 253; Baker in Journ. of Bot. 1874, 280. *A. rubellum* and var. *grandiflorum*, Lebed., Fl. Ross. iv. [1852] 171. *A. leptophyllum* Wall., Cat. [1829-32] 5073. *A.*; Kunth, l. c. 456. *A. Jacquemontii*. Kunth l. c. 399. *A. longisepalum* Bert. in Nov. Comm. Acad. Bonon. [1842] 429. *A. tenue* G. Don Monogr. All. [1827] 34; Koch in Linnaea xxii [1849] 238.

[Description: see Vvedensky no. 117; *Herbertia* 11(1944): 162-163. 1946.]

The Punjab and western Himalaya, alt. 1500-8000 ft.; from Kashmir to Kumaon.—Distrib. Westwards to the Ural and Caucasus, and in Siberia.

I have followed Boissier in the limitation of this species and its varieties. Regel refers Don's *tenue* to *A. Pallasii* Murray which is described as having a long style; he retains as a species Boissier's *A. Griffithianum*, which the latter author has reduced to a variety of *rubellum*.

Var. 1. *grandiflorum* Boissier, Fl. Orient. v. [1882] 253; pedicels longer, flowers larger, sepals 1/6 to 1/3 in. [4-8 mm.] long subacute, filaments much shorter, and broader. *A. Griffithianum* Boiss. Diagn. Ser. 2, iv [1859] 117; Regel, All. Monogr. [1875] 108; Baker, l. c. [1874] 290. *A. vulcanicum* Boiss., in Plant. Gotsch. Pers. Bot. No. 49.—Kashmir, alt. 5-7000 ft., Westward to Persia.

Var. 2. *parviflorum* Ledebour, Fl. Ross. iv [1852] 171; flowers smaller, sepals 1/6 in. [4 mm.] long. *A. syntamanthum* C. Koch in Linnaea xxii [1849] 239; Regel, All. Monogr. [1875] 110.—Western Himalaya. Westward to S. Russia.

[Notes.—*A. rubellum* sensu lato, as accepted by Ledebour, Boissier and Hooker, is divided by Vvedensky into several species of which *A. Griffithianum* Boiss. and *A. Jacquemonti* Kunth, non Regel, occur in India.—W. T. S.]

6. *A. ROYLEI* Stearn, *nom. nov.*; [*A. lilacinum* Royle, Ill. (1840) 392 (name only)]; leaves terete or channelled, longer or shorter than the scape, head hemispheric, pedicels twice as long as or longer than the campanulate small pale red flowers, sepals ovate or ovate-lanceolate acute or obtuse, filaments exerted inner 2-toothed at the very base. Regel, All. Monogr. [1875] 89. *A. rubena* Baker in Journ. of Bot. 1874, 293 (not of Schrad.).

Western Himalaya, alt. 6-7000 ft.; from Garwhal westwards.

Bulb ovoid; coats scarious, red-brown. Leaves 2-3, Scape 8-10 in. [c. 20-26 cm.], fistular. Head 1-1½ in. [2.5-2.8 cm.] diam.; spathes 2, acuminate; pedicels ¼ to ⅛ in. [6-8 mm.]. Sepals ¼ in. [6 mm.] long, with the filaments inserted near their bases; anthers large.

[Notes.—A new name, *A. Roylei* Stearn, is needed for *A. lilacinum* Royle ex Regel, All. Monogr. (1875) 89, owing to the earlier publication of *A. lilacinum* Klotzsch in Klotzsch et Garcke, Bot. Ergeb. Reise Pr. Waldemo (1862) 50, syn. *A. Klotzschii* Regel, l. c. (1875) 255, *nom. provis.*, an obscure Himalayan plant inadequately described from a specimen without bulb or leaves but apparently distinct from *A. Roylei* in having a one-valved spathe and oblong-spathulate perianth-segments. *A. Roylei* commemorates John Forbes Royle (1799-1858), pioneer economic botanist in India and author of *Illustrations of the Botany . . . of the Himalayan Mountains* (1833-40); cf. Kew Bull. 1933, 378-390; Journ. Arnold Arb. xxiv (1943) (484-487) wherein *A. lilacinum* Royle is mentioned as occurring “on Mussooree” but not described.—W. T. S.]

SECT. II. RHIZIRIDEUM [Spelled *Rhiziridium* by Hooker but *Rhizirideum* by G. Don.—W. T. S.] Bulbs solitary or clustered upon an erect or creeping rootstock. Leaves flat.

A. Scales of bulb membranous, not of reticulated fibres.

* Stamens longer than the perianth.

7. *A. BLANDUM* WALLICH, Pl. As. Rar. iii [1832] 38, t. 260; tall, stout, leaves flat broadly linear obtuse shorter than the tall scape, head globose very dense-fld., pedicels shorter than the campanulate pale pink flowers, sepals oblong obtuse, filaments simple subulate much exerted. Kunth, Enum. iv. [1843] 396; Baker in Journ. of Bot. 1874, 295. *A. obtusifolium* Klotzsch & Garcke, Bot. Reise Pr. Wald. [1862] 51, t. 95.

Western Himalaya, alt. 13-17,000 ft.; in the interior ranges, and in Western Tibet, from Kumaon to West Nepal.

Bulb large, oblong, often 5 by 1½ in. [12.7 by 2.5 cm.]; scales coriaceous, entire. Leaves 5-10 [12.7-25.5 cm.] by ⅓-½ in. [8-13 mm.], ensiform, recurved tip rounded. Scape 1-2 ft. [30.5-61 cm.] terete, leafy below the middle. Head 1-1½ in. [2.5-3.8 cm.] in diam.; spathes ovate, obtuse. Sepals ⅓ in. [8 mm.] long. Filaments much longer than the sepals, inserted near their bases, rather longer than the style.

[Notes.—An earlier name for *A. blandum* seems to be *A. carolinianum* Redouté, Liliac. ii [1804] t. 101. This was published as a North American species but is “not known in America” (S. Watson in Proc. Amer. Acad. Arts Sci. xiv [1879] 234.)—W. T. S.]

8. *A. STRACHEYI* Baker in Journ. of Bot. (1874) 293; slender, leaves narrowly linear obtuse, scape slender compressed above, head globose or hemispheric dense-fl'd., pedicels shorter than the campanulate rosy or pale yellow flowers, sepals oblong obtuse, filaments simple, free, much exserted. Regel, All. Monogr. (1875) 135. *A. longistamineum* Royle, Ill. [1840] 392 (name only).

Western Himalaya; from Kashmir, alt. 9000 ft., *Clarke*, to Kumaon, alt. 10-12,000 ft., Strachey & Winterbottom, Edgeworth.

Bulbs small, clustered, narrowly ovoid, outer scales fibrous, produced into a long neck. Leaves 3-4, 12 by 1/12 in. [30.5 by 0.2 cm.], tips rounded. Head 1 in. [2.5 cm.] diam.; spathes small, deltoid; pedicels 1/12-1/4 in. [2-6 mm.], about as long as the sepals. Filaments filiform, inserted on the bases of the sepals. Ovary globosely trigonous, cells 2-ovuled.—The Kashmir specimens have very pale yellow flowers.

9. *A. CONSANGUINEUM* Kunth, Enum. iv. [1843] 431; leaves slender, narrowly linear, obtuse, flat keeled, head hemispheric, pedicels equaling or rather longer than the campanulate golden flowers, filaments simple, filiform, much longer than the oblong obtuse sepals. Regel, All. Monogr. [1875] 131; Baker in Journ. Bot. 1874, 293.

Western Himalaya; Kashmir, alt. 8-10,000 ft., *Jacquemont*, *Thomson*, etc.

Habit and characters of *A. Stracheyi*, but larger, flowers golden yellow, with longer pedicels, and larger, longer bulbs with fibrous sheaths. Filaments inserted on the bases of the sepals. Style slender, far exserted.

10. *A. PLATYSPATHUM* Schrenk, Enum. Pl. Nor. i [1841] 7, ii. [1842] 8; Kunth, Enum. iv. [1843] 453; Regel, Monogr. All. [1875] 135; Ledeb. Fl. Ross [1852] 184 (excl. var. β).

[Description: see Vvedensky no. 54; HERBERTIA 11 (1944): 128-129. 1946.]

Western Tibet: (Var. β , only), Herb. Calcut. (Regel).—Distrib. Kensu.

Var. β . *falcatum* Regel l. c.; leaves ligulate, glaucous, falcate; head globose dense-fl'd., flowers rose-lilac. I have seen no specimen of this variety, which Regel suggests may be a different species.—The type inhabits Soongaria and Turkstan.

11. *A. THOMSONI* Baker in Journ. of Bot. 1874, 294; leaves rather stout linear, fleshy, obtuse, shorter or longer than the scape, head globose, pedicels equaling or shorter than the red-purple campanulate flowers, sepals oblong-lanceolate, acute, filaments simple, filiform, much exserted, anthers minute. Regel, All. Monogr. [1875] 141.

Kashmir; alt. 12,000 ft., *Thomson*.

Bulbs tufted, narrowly ovoid; outer scales hard, chestnut-brown, entire. Leaves 4-5, 6-9 by 1/6-1/3 in. [15.2-22.8 cm. by 4-8 mm.], sheath-

ing the lower third of the stout, terete scape, which is 1-2 ft. [30.5-61 cm.] long, tip rounded. Head 1-1½ in. [2.5-3.8 cm.] diam.; spathes short, deltoid. Sepals ¼ in. [6 mm.] long; with the filaments on the bases. Ovary globose, cells 2-ovuled, style much exserted.—Baker observes that this is closely allied to *A. blandum*, differing in the slender habit, narrower leaves, and longer, more acute sepals.

12. *A. BAKERI* Regel, All. Monogr. [1875] 141; leaves basal, narrowly linear, scape tall, slender, head lax-fld., pedicels much longer than the campanulate red-purple flowers, sepals orbicular or oblong obtuse, filaments simple, linear-subulate, inner dilated, and 2-toothed at the base, anthers minute. *A. splendens* Miq. Ann. Mus. Bot. Lugd. Bat. iii. [1867] 154; *A. exsertum* Herbert in Bot. Reg. xxxiii [1847] under t. 5.

Khasia Hills; alt. 4-5500 ft.—Distrib. China, Japan.

Bulbs clustered, 1 in. [2.5 cm.] long, ovoid-oblong; scales white, membranous. Leaves 2-4, 6-9 by 1/12 in. [15.2-22.8 by 2 mm.], shorter than the slender terete scape. Head few- or many-fld.; pedicels ¼-¾ in. [1.3-1.9 cm.]. Sepals 1/6-¼ in. [4-6 mm.] long, with the filaments on their bases. Ovary subglobose, style far exserted.

** Stamens equaling or shorter than perianth.

13. *A. WALLICHI* Kunth, Enum. iv. [1843]; tall, leaves long linear or ensiform, flat, longer than the stout triquetrous scape; head lax-fld., pedicels much longer than the simple filaments elongate-subulate. Regel, All. Monogr. [1875] 142; Baker in Journ. Bot. 1874, 291. *A. caeruleum* Wall. Cat. [1829-32] 5076 (not of Pallas) *A. violaceum* Wall. mss.

Temperate Himalaya, alt. 8-13,000 ft. from Kumaon to Sikkim. Gilgit, *Tanner*.

Bulbs hardly developed, clustered, base of stem thickened, clothed with membranous entire and toen sheaths. Leaves basal, 2-3 ft. [61-92 cm.] by ⅓-3/3 [8-17 mm.], margins erose, narrowed to a point. Scape 1-2½ ft. [30.5-76 cm.] ft. Head 2-3 in. [5-7.6 cm.] diam.; pedicels 1-1½ in. [2.5-3.8 cm.]; spathes caducous, as long as the pedicels. Sepals ½ in. [1.3 cm.], obtuse; filaments inserted on their bases. Capsule turbinate.

14. *A. HOOKERI* Thwaites, Enum. [1946] 339; slender, leaves basal, linear, membranous, shorter than the tall subtrigonous scape, 1-nerved; head globose, laxly many-fld., pedicels much longer than the stellate white flowers, sepals linear acuminate, about equaling the filiform filaments. *A. Wallichii* var. Regel, All. Monogr. [1875] 143.

Khasia Hills; at Kala Pana, alt. 5000 ft. *J. D. H. & T. T. Ceylon*; Newera Elia, alt. 7000 ft., *Thwaites*.

Bulb hardly any; base of stem clothed with long narrow membranous sheaths. Leaves 12-18 by ¼-⅓ in. [30.5-45.7 cm. by 6-8 mm.], acute. Scape 1-2 ft. [30.5-61 cm.]; heads 1½ in. [3.8 cm.] diam.; spathe with a long tail; pedicels ½-2/3 in. [1.3-2 mm.], capillary. Sepals ¼ in. (6 mm.); filaments inserted on their bases. Capsule obcordate; cells usually 1-seeded.

[Notes—*A. Hookeri* occurs also in Tibet, Yunnan and Szechwan; cf. Airy Shaw in Notes Roy. Bot. Gard. Edinburgh xvi (1931) 139.—*W. T. S.*]

15. *A. SIKKIMENSE* Baker in Journ. of Bot. 1874, 292; leaves basal, narrowly linear, channeled, shorter than the slender flexuous scape; head dense-fl'd., pedicels unequal, longer or shorter than the campanulate lilac-purple flowers, filaments broadly subulate, much shorter than the oblong subacute or obtuse sepals. Regel, All. Monogr. [1875] 146.

Sikkim Himalaya; in the inner ranges, alt. 11-14,000 ft. *J. D. H., Elwes.*

Bulbs tufted, slender, cylindric; outer scales of long parallel fibres. Leaves 2-3, 3-4 by $1/12$ - $1/4$ in. [7.6-10.2 cm. by 2-6 mm.], subacute. Scape 4-12 in. [10.2-30.5 cm]. Head 6-15-fl'd.; pedicels $1/12$ - $1/4$ in. [2-6 mm.]; spathe solitary, broadly ovate. Sepals $1/3$ to nearly $1/2$ in. [8-12 mm.]; inner filaments with a broad triangular base adnate to the bases of the sepals, outer narrower, free. Capsule 3-lobed. Ovary subglobose; style included, cells 2-ovuled. Baker regards this species as intermediate between the smaller vars of *A. angulosum* and *Schoenoprasum*.

[Notes.—*A. sikkimense* is figured in Bot. Mag. cxlvi (1920) t. 8858. —*W. T. S.*]

B. Outer scales of the bulb of reticulated fibres, obscurely so in *tuberosum*.

* Stamens longer than the perianth.

16. *A. JACQUEMONTI* Regel, All. Monogr. [1875] 162 (not of Kunth); leaves basal filiform, subterete, shorter or equaling the slender strict scapes; head globose or subglobose, pedicels shorter or longer than the lilac campanulate flowers; sepals oblong-lanceolate, obtuse or subacute, filaments exserted, subulate, inner with a dilated 2-toothed base. *A. junceum* Jacquem. mss.; Baker in Journ. Bot. 1874, 295 (not of Smith). *A. leptophyllum* Wall., Cat. [1829-32] no. 5073 B [not of Schur].

Western Tibet, alt. 12-14,000 ft., *Jacquemont, Thomson*; north of Kumaon, alt. 16,500 ft., *Strachey & Winterbottom*.

Bulbs tufted, cylindric, elongate; fibrous coats very finely reticulate, rusty brown. Leaves 3-6, 4-6 by $1/24$ in. [10.2-14 cm. by 1 mm.]. Scape 3-9 in. [7.6-22.9 cm.]. Head $1-1\frac{1}{2}$ in. [2.5-3.8 cm.] diam.; spathes 2, membranous; pedicels $1/12$ - $1/4$ in. [2-6 mm.]. Filaments inserted much above the bases of the sepals, shortly exserted, inner obscurely toothed at the base. Capsule globosely ovoid; style very long. Much eaten in Western Tibet. Baker regards it as possibly a variety of the Siberian *A. lineare*, which has broader leaves and much broader inner filaments.

[Notes.—The correct name for *A. Jacquemonti* Regel (1875) non Kunth (1843) is probably *A. Stoliczki* Regel, All. Monogr. (1875) 161; these two appear to be conspecific, and the first name must be rejected as a homonym. *A. Stoliczki* commemorates the explorer Ferdinand Stoliczki (1838-1874).—*W. T. S.*]

17. *A. AURICULATUM* Kunth, Enum. iv. [1843] 418; leaves narrowly linear, flat, obtuse, stout, shorter than the terete striate scapes; head globose, very dense-fl'd., pedicels about equaling the very small campanulate purplish flowers; filaments as long as the oblong obtuse sepals,

outer broadly subulate, inner auricled at the base, stigma penicillate. Baker in Journ. of Bot. 1874, 295.

Western Himalaya; Kumaon, Jacquemont.

Bulb elongate, narrow, seated on an oblique rootstock; scales brown, reticulate, exactly as in *A. Jacquemonti*. Leaves 6-9 by $1/6$ - $1/3$ in. [15.2-22.9 cm. by 6-8 mm.], margins erose. Scape 12-18 in. [30.5-45.7 cm.], strict. Head $3/4$ in. [1.9 mm.] diam.; spathes 2-3, short, acuminate; pedicels $1/8$ in. [3 mm.]. Sepals $1/8$ in. [3 mm.] long; filaments on the base of the sepals, outer rather shorter than the inner. Ovary subglobose.

18. *A. VICTORIALIS* Linn. Sp. Pl. [1753] 295; Kunth, Enum. iv. [1843] 432; G. Don, Monogr. All. [1827] 96; Regel, All. Monogr. [1875] 170; Baker in Journ. of Bot. 1874, 291; Boiss. Flor. Orient. v [1882] 245; Jacq. Fl. Austr. iii [1775] t. 216; Reichb., Ic. Fl. Germ. x [1848] t. 508; Redoute, Lil. v. [1809] t. 265; Bot. Mag. [1809] t. 1222. *A. ellipticum* Wall., Cat. [1829-32] no. 5069; Kunth, l. c. 456.

[Description. see Vvedensky no. 1; HERBERTIA 11 (1944): 98-99. 1946.]

Temperate Himalaya, alt. 7-12,000 ft., from Kashmir eastwards to Sikkim. Distrib. Europe, N. Asia to Japan; N. W. America.

Var. *angustifolium*; leaves $1/2$ - $1 1/4$ in. [1.3-3.2 cm.] broad, flowers pale pink.—Interior of Sikkim, alt. 10-12,000 ft. West Nepal, *Duthie*.

[Notes.—The occurrence of the true *A. Victorialis* in the Eastern Himalaya, i. e., east of Kumaun, is doubtful. The Sikkim plants referred to *A. Victorialis* and *A. Victorialis* var. *angustifolium* by Hooker and W. W. Smith and G. H. Cave in Rec. Bot. Surv. India, iv (1911) 247, appear to be specifically distinct in having normally only two leaves (in young plants only one leaf) which are more or less basal, narrowly lanceolate, and less than 4 cm. broad; the flowers are rose or red (not whitish), with the stamens hardly longer than the perianth segments. The young leaves have their margins inrolled but are not markedly plicate. On a journey through Sikkim in May 1945, I found this species to be not uncommon in northern Sikkim, near the Lachen River between Tālam and Thanggu, growing in deep leaf-mould and alluvial soil beneath bushes of *Rosa*, *Rhododendron*, *Salix* and *Betula*, but it was not yet in flower. The local inhabitants gather the leaves for seasoning curries and call it “Kok-pa,” a Tibetan word applied to garlic and related plants (cf. Gould and Richardson, Tibetan Word Book, no. 902: 1943) and not confined to this species. Pending the comparison of type-material this species of Sikkim and adjacent Tibet and Bhutan may be referred provisionally to *A. Prattii* C. H. Wright in Journ. Linn. Soc. Bot. xxxvi (1903) 124, described from western China (Sikang: Tatssienlu, Tongola).—W.T.S.]

19. *A. SCHRENKI* Regel, All. Monogr. [1875] 172.

[Description: see Vvedensky no. 14; HERBERTIA 11 (1944): 106-107. 1946.]

Himalaya Mts., Hort. Calcutt. (Regel). Distrib. Siberia.

I have seen no Himalayan specimen. Regel says it differs from the widely diffused *A. strictum* Schrad. in the capitate stigma.

[Notes.—Vvedensky (1935) unites *A. Schrenki* Regel with *A. strictum* Schrader.—W.T.S.]

** Stamens shorter than the perianth.

20. *A. ODORUM* Linn., Mant. [1767] 62; Kunth, Enum. iv. [1843] 185; Regel, All. Monogr. [1875] 175; (excl. syn. *A. tuberosum* etc.) Baker in Journ. of Bot. 1874, 291; *A. tataricum* Linn. fil., Suppl. [1781] 196; Ait., Hort. Kew ed. 2, ii [1811] 233; Redoute, Lil. [1804] t. 98; Bot. Mag. [1808] t. 1142.

[Description: see Vvedensky no. 36; HERBERTIA 11 (1944): 118. 1946.]

Western Tibet; alt. 10-14,000 ft. Thomson. Western Nepal, alt. 13,000 ft. Duthie. Distrib. N. Asia, Japan.

[Notes.—The correct name for *A. odorum* Linn. is *A. ramosum* Linn. Sp. Pl. i (1753) 296. —W. T. S.]

21. *A. TUBEROSUM* Roxburgh, Hort. Beng. [1814] 24 (name only); Fl. Ind. ii [1832] 141; leaves 4-5, basal, erect, narrow-linear, flat, tall, compressed or trigonous above; head lax-fl'd., pedicels much longer than the small white or pink stellate flowers, sepals oblong-lanceolate; filaments simple, linear, included, connate below and perigynous, style short. Baker in Journ. of Bot. 1874, 292; Kunth Enum. iv. [1843], 454; Wall. Cat. [1829-32] no. 5068; *A. Roxburghii*, Kunth l. c. 454. *A. uliginosum* G. Don, Monogr. All. [1827] 60; Kunth, l. c. 422. *A. senescens* Mig. Ann. Mus. Bot. Lugd. Bat. iii [1867] 154.

Western Himalaya, Royle. Khasia Mts., alt. 5-6,000 ft. (apparently wild), Griffith etc. Cultivated in Bengal, Roxburgh. Distrib. China, Siam, Japan.

Bulbs elongate, cylindric, with white fleshy root-fibres; scales grey, fibrous. Leaves 6-12 by 1/12-1/6 in. [15.2-30.5 cm. by 2-4 mm.]; sometimes concave and twisted. Scape 1-1 1/2 ft. [30.5-45.7 cm.]. Head 20-40 fld., hemispheric, 1-1 1/2 in. [2.5-3.8 cm.]; spathes 1-2, small; pedicels ascending 1/2-1 1/4 in. [1.3-3.2 cm.]. Sepals 1/6-1/4 in. [4-6 mm.]) acute or obtuse, at length reflexed, filaments inserted on the bases of the sepals, gradually dilated from below the middle to the base, outer shorter, broader. Ovary globosely obovoid, deeply 3-lobed; stigma obscurely 3-toothed; cells 3-ovuled. Capsule obcordate. Regel cites this as a synonym of *A. odorum*, and it is possible that it may be the cultivated form of that plant. Wallich's specimens are from the Mission Garden, Tranquebar.

[Notes.—This species should be cited as *A. tuberosum* Rottier ex Sprengel, Syst. ii (1825) 38. —W.T.S.]

22. *A. GOVANIUM* Wallich, Gat. [1829-32] no. 5071; leaves many, basal, sub-distichous, linear, flat, obtuse, about equaling the acutely angled scape, tip rounded; head many-fl'd., pedicels equaling or exceeding the white stellate flowers, sepals narrow at length reflexed, filaments very short, perigynous, subulate, included, bases dilated, connate. Baker in Journ. of Bot. 1874, 293; Regel, All. Monogr. [1875] 177. *A. humile* Kunth, Enum. iv. [1843] 443; Regel l. c.; *A. nivale* Jacquem. mss.

Temperate Himalaya; from Kumaon westwards, alt. 8-12,000 ft.

Bulbs and foliage as in *A. odorum*, from which it differs in the acutely angled scape, in the larger flowers with narrower sepals, $\frac{1}{2}$ in. [1.3 cm.] long, and much shorter stamens. The name *humile* being quite inappropriate, except for a very dwarfed state, I follow Baker in retaining Wallich's, which commemorates the discoverer of the species.

[Notes.—Under the International Rules of Botanical Nomenclature, the correct name for this species is *A. humile* Kunth (1843), no matter how inappropriate; *A. Govanianum* Wall. was a nomen nudum until taken up by Baker in 1874. — W. T. S.]

23. *A. OREOPRASUM* Schrenk in Bull. Sci. Acad. Sci. Petersb. x [1842] 354; Enum. Pl. Nov. ii [1842] 6; Ledeb., Fl. Ross. iv. [1852] 185; Regel, All. Monogr. [1875] 180.

Western Tibet; Zalung-Karpo Pass, alt. 10-17,000 ft., *Stoliczka* (Regel). Distrib. Soongaria, Eastern Turkestan.

Described from Turkestan specimens, I have seen no Indian.

[Description: see Vvedensky no. 35; HERBERTIA 11 (1944): 117. 1946.]

24. *A. CLARKEI* Hooker f.; leaves very many, sub-basal, erect, very narrowly linear or filiform, shorter than the slender scape; head lax-fl'd., pedicels much longer than the stellate white flowers, filaments hardly as long as the linear-oblong acuminate sepals, inner broadly oblong, obtusely-toothed below the middle.

Kashmir at Skardo, alt. 7-11,000 ft., *Clarke*.

Bulb small, ovoid, 1 in. [2.5 cm.], outer scales closely finely reticulated, pale. Leaves 4-8, 6-12 by $\frac{1}{10}$ - $\frac{1}{6}$ in. [15.2-30.5 cm. by 3-4 mm.], obtuse, flat. Scape 12-18 in. [30.5-45.7 cm.], terete; head 1-1 $\frac{1}{2}$ in. [2.5-3.8 cm.] diam.; spathes 2, one or both as long as the pedicels or shorter; pedicels $\frac{1}{2}$ - $\frac{2}{3}$ in. [1.3-1.8 cm.]. Sepals $\frac{1}{8}$ in. [3.2 mm.], acuminate; filaments inserted near their bases, anthers large. Ovary globose; style included. Capsule broadly obcordate, $\frac{1}{6}$ in. [4 mm.] diam. Habit of *A. tuberosum*.

[Notes.—*A. Clarkei* is doubtfully distinct from *A. tuberosum*. — W. T. S.]

SECT. III. MOLIMUM. Bulbs not seated on a rootstock. Leaves flat or keeled. Spathes shorter than the head.

25. *A. ATROPURPUREUM* Waldstein & Kitaibe, Pl. Rar. Hung. i [1802] 16, t. 17; Regel, All. Monogr. [1875] 247; Don, Monogr. All. [1827] 90; Kunth, Enum. iv [1843] 448; Boiss. Fl. Orient. v [1884] 757; Reichb., Ic. Fl. Germ. x [1848] t. 505. *A. robustum* Karel. & Kiril., Enum. Pl. All. [1841] n. 855; Kunth l. c. 446; Ledeb. Fl. Ross. iv [1852] 187; Baker in Journ. of Bot. 1874, 289.

[Description; see Boissier no. 130.]

Western Himalaya; from Kashmir, *Falconer*, to Kishtwar, alt. 8-10,000 ft., *Thomson*. Distrib. Westwards to Hungary, Turkestan, Siberia. Afghan specimens have leaves 2 $\frac{1}{2}$ in. [6.4 cm.] broad.

[Notes.—*A. atropurpureum* Waldst. et Kit. of southeastern Europe and *A. robustum* Kar. et Kir. of the Dzungaro-Tarbagatai region of Cen-

tral Asia are considered distinct species of Vvedensky (1935). The Himalayan material probably belongs to neither —W. T. S.]

26. *A. LORATUM* Baker in Journ. of Bot. 1874, 290; leaves 3-5, linear-lanceolate, flat, flaccid, ciliolate, longer than the slender terete scape; head many and dense-fld., pedicels short but longer than the campanulate white perianth, filaments equaling the lanceolate acute sepals, inner subulate, outer linear with subulate tips.

Western Himalaya and Tibet; Kishtwar and Banahal, alt. 10-14,000 ft., *Thomson*.

Bulb small, ovoid, outer scales membranous, grey. Leaves 2-5, 6-9 by $\frac{1}{2}$ -1 in. [15.2-22.9 cm. by 1.3-2.5 cm.], narrowed from above the base. Scape 3-6 in. [7.6-15.2 cm.]; Head 30-50 fld.; spathes 2, navicular, acute; pedicels, $\frac{1}{8}$ - $\frac{1}{2}$ in. [8-1.3 mm.], tip thickened. Sepals $\frac{1}{10}$ - $\frac{1}{6}$ in. [3-4 mm.]; midrib brown; filaments inserted on their bases; ovary globosely triquetrous; style very short. Baker says that this, judging from the very imperfect specimens, closely resembles *A. narcissifolium* Linn., the handsomest of the European species. Near *A. atropurpureum*, but the leaves are broader, and the head globose, with much shorter pedicels and paler flowers.

27. *A. MACRANTHUM* Baker in Journ. of Bot. 1874, 293; leaves many, linear, gradually acuminate, keeled, scapes many grooved and ribbed, head lax-fld., pedicels much longer than the large campanulate dark purple flowers, filaments filiform, equaling the oblong, obtuse sepals. Regel, All. Monogr. [1875] 182; Bot. Mag. [1884] t. 6789.

Sikkim Himalaya; in the inner ranges alt. 12-13,000 ft., *J. D. H.*; *Elwes*.

Bulb narrow, coats membranous. Leaves 6-9, 18 by $\frac{1}{4}$ - $\frac{3}{4}$ in. [45.7 cm. by 6-19 mm.]. Scape robust, 1-2 ft. [30.5-61 cm.], pedicels 1-2 in. [2.5-5 cm.], stout. Sepals $\frac{1}{4}$ - $\frac{1}{2}$ in. [8-1.3 mm.]; filaments inserted on their bases, dilated at the very base; anthers large; ovary deeply 2-lobed, stigma capitellate. A very beautiful species, resembling *A. narcissiflorum* Vill. Regel cites it in Sect. RHIZIRIDEUM, but it is not known to have a rootstock.

[Notes.—*A. MACRANTHUM* Baker, syn. *A. oviflorum* Regel in Gartenflora xxxii (1883) 321, t. 1134, Acta Horti Petrop. viii (1883) 659, *A. Simethis* Léveillé et Giraudias in Fedde, Repert. Sp. Nov. xii (1913) 288, occurs also in southern Tibet, Yunnan and Shensi; cf. Rendle in Journ. of Bot. xlv (1906) 44, Airy Shaw in Notes Roy. Bot. Gard. Edinburgh xvi (1931) 147. —W. T. S.]

28. *A. CHITRALICUM* Wang et Tang in Bull. Fan Memorial Inst. Biol. Peiping, Bot. Ser. vii (1927) 298.

Bulb globose-ovoid, 1.5 by 1.5 cm., 1.5 by 1 cm., 1 by 1 cm.; outer envelopes papery, grey-brown, the inner ones scarious, white. Stem terete, glabrous, 13-23 cm. high, bearing one leaf above the base. Leaf narrowly linear, channelled above, a little longer than the stem, 3-9 mm. wide. Spathe 2-valved; valves ovate, acuminate, pale rose, a little shorter than the pedicels. Umbel capsule-bearing, hemispherical, 1.5-2.5 cm. in diameter; pedicels equal in length, glabrous, $1\frac{1}{2}$ to twice as long as the

perianth. Perianth almost stellate, pale rose, segments linear-lanceolate, bluntish, 4-5 mm. long, soon withering, reflexed, twisted. Filaments almost as long as to slightly shorter than the perianth-segments, fused at base into a ring, simple, abruptly awl-shaped from a more-or-less toothed square base. Ovary shortly stalked, papillose, obviate, 2 by 2.5 mm.; style longer than the ovary and stamens; stigma undivided.

An ally of *A. dasyphyllum* Vved. (Vvedensky no. 199; Fl. URSS iv. 264) but easily distinguished by its glabrous leaves and shoulder-based filaments toothed on each side.

Hab.: Chitral, alt. 8-11,000 ft. (3 June 1895; Harriss no. 16691a; type in Kew Herb.)

29. *A. FASCICULATUM* Regel in Journ. of Bot. xliv (1906) 42; *A. GATEANUM* W. W. Smith in Records Bot. Surv. India iv (1911) 247.

Plant glabrous, 12-36 cm. high. Bulb slender, obsolete, surrounded at base with coarse parallel fibres and bearing a tuft of fleshy subfusiform or cylindric roots about 2 cm. long; rootstock short, compressed. Stem surrounded below from $\frac{1}{4}$ to $\frac{1}{3}$ or more of its length with colorless sheaths, fistular, smooth, somewhat compressed. Leaves 3-4, basal, flat, limp, many-nerved, scabridulous at the margin, most often longer than the stem, reaching about 20 mm. long, 3-4 cm. wide. Spathe broadly ovate, acutish, veined, shorter than the umbel, nearly 2 cm. long. Umbel spherical, densely many-flowered, without bulbils, 2.5 cm. or less in diameter; pedicels about $1\frac{1}{2}$ times as long as the flowers. Perianth whitish, tubular at base, broadly campanulate above; segments lanceolate, acute, equal, 5 mm. long, barely 1.5 mm. wide. Filaments subulate, entire, adnate to the segments at base, barely equal to the segments; anthers cordate 0.5 mm. long. Ovary subglobose, conspicuously 3-furrowed, shortly stalked, 1 mm. long; style short, 2 mm. long. Capsule about 3 mm. long.

A well-marked species, perhaps nearest the North Asiatic *A. odorum* L. from which it is distinguished by its smaller flowers, the coarse persistent fibres of the obsolete bulb-scale, and the absence of an obliquely-jointed rootstock.

Hab.: Tibet; Phari (Dungboo, July); Teling (Dungboo, Aug. 1879); Kang-me, north of Phari (Dr. King's collector, Aug. 1882); Khambajong (Younghusband, in flower, no. 89, July 1903; Prain, in fruit, Sept. 1903); Gyangtse (Walton no. 68, July to Sept. 1904).

[Notes.—This description is taken from Rendle (1906); the original description of *A. Gageanum* agrees in all essentials and is based on specimens collected in the upper valleys of Llonakh, Sikkim, at 15-16,000 ft. (Smith & Cave, 2130; Ribu, 2771).]

30. *A. GILGITICUM* Wang et Tang in Bull. Fan Memorial Inst. Biol. Peiping, Bot. Ser. vii (1937) 294.

Bulbs elongate-cylindric; outer envelopes scarious; rhizome perpendicular. Stem terete, glabrous, 54-60 cm. high, longer than the leaves, with the leaves crowded about the base. Leaves 6, linear, drawn out towards the blunt tip, glabrous on both sides, glaucous below, 0.8-1.6 cm. wide. Spathe one-valved; valve broadly ovate, bilobed at the tip, slightly

rose, shorter than the pedicels. Umbel capsule-bearing, fasciculate, 20-30 flowered, 6-9 cm. wide; pedicels unequal, glabrous, 2-5.5 cm. long, naked at base. Perianth rose; segments erect-spreading, lanceolate, attenuate-acute at the tip, 10-12 mm. long. Filaments shorter than the perianth, linear awl-shaped, simple. Ovary globose, about 2 mm. in diameter, with small sacs at base; style longer than the ovary and about as long as the stamens; stigmas 3, recurved.

This species has resemblances to *A. rhynchogynum* Diels, which is characterized by a notably 3-beaked ovary topped by a simple stigma and from which *A. gilgiticum* differs in its non-beaked ovary, distinctly 3-lobed stigma, more-flowered umbel and unequal pedicels.

Hab.: Gilgit (1880; Tanner no. 166; type in Kew Herb.).

31. *A. PHARIENSE* Rendle in Journ. of Bot. xliv (1906) 42.

Plant glabrous, about 12 cm. high. Bulb solitary, narrowly ovoid, prolonged upwards into the sheathed base of the stem, about 2 cm. long, 1 cm. wide, mounted on a thick perpendicular rhizome; envelopes scarious, the inner reddish. Stem smooth, terete, compressed in the upper part, bearing leaves below the middle. Leaves 2-4, flat, narrowly linear, blunt, a little longer than the stem, the upper part recurved, to 8 cm. long, 2 mm. wide. Spathe one-valved, scarcely beaked, shorter than the umbel, 1 cm. long. Umbel spherical, densely many-flowered, 2 cm. in diameter; pedicels scarcely $\frac{1}{2}$ as long as the flowers. Perianth open-campanulate, white, chaffy in a dried state; segments equal, narrowly obovate, blunt, 5 mm. long. Filaments simple, free, very narrowly subulate, inserted near the base of the segments, 8 mm. long. Ovary subglobose, with 2 ovules in each chamber, barely 2 mm. long; style slender, nearly 6 mm. long.

A well-marked species, perhaps most nearly allied to the Western Himalayan *A. blandum* Wall., but a much smaller plant and distinguished also by its very shortly pedicelled white flowers.

Hab.; Tibet; Po-tong-lo, 2 miles north of Pari (Dungboo, Aug. 16, 1878).

32. *A. TIBETICUM* Rendle in Journ. of Bot. xliv (1906) 41.

Plant glabrous, 10-16 cm. high, tufted. Bulb narrowly cylindric, mounted on an apparently ascending rhizome; envelopes membranous, pale brown, at length breaking up into parallel fibres. Stem almost terete. Leaves 2-3, sheathing the base of the stem, most often scarcely reaching to the umbel, linear, a little narrowed in the upper part, with the margins slightly scabrid and involute, 3 mm. wide when flattened. Spathe one-valved, broadly boat-shaped and shortly beaked, shorter than the umbel. Umbel densely few-flowered, 1-2 cm. in diameter; pedicels rarely more than $\frac{1}{2}$ as long as the flowers. Perianth subglobose-campanulate, "deep blue," 5 mm. long; segments blunt, the inner broadly ovate-oblong, the outer a little shorter, ovate, concave. Filaments about $\frac{1}{3}$ shorter than the perianth, the outer with the base narrowly triangu-

[ALLIUMS — INDIA, continued on page 174.]

ON THE ORIGIN OF TAPEINANTHUS HUMILIS HERB.

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[Translated from the French into English by Thomas W. Whitaker.]

INTRODUCTION

The sub-tribe *Narcissinae* Link of the tribe *Narcisseae* Endl. of the family *Amaryllidaceae* Lindley is composed of the genera *Cryptostephanus* Welw. ex Bak., *Tapeinanthus* Herb. and *Narcissus* L. While the last genus has been studied intensively from the point of view of cytology with the aim of illuminating its systematics (see Fernandes, 1931, 1934, 1937 *a, b*, 1940 and 1943), the cytology of the first two has not yet been the object of such work.

Having obtained truly encouraging results with the genus *Narcissus*, we have resolved to extend the research to all members of the sub-tribe, with aim of contributing to a clearing up of the relationship between the three genera. Unfortunately all of the arrangements made with the object of procuring material of the genus *Cryptostephanus* have failed, this occurred because of the fact it is a question of African plants, growing in distant localities and difficult of exploration. Meanwhile, we have succeeded in obtaining some bulbs of *Tapeinanthus humilis* Herb. from which we have made a study of the somatic chromosomes of this plant. This study has permitted us to decipher the relationship between this genus and the genus *Narcissus*, and to formulate a hypothesis of the probable origin of *Tapeinanthus humilis*. We are here presenting the results of our researches.

MATERIALS AND TECHNIQUE

The plants were received from Jerez de la Frontera, in the Spanish province of Andalousia.¹ The bulbs, cultivated in pots at the Botanical Garden of Coimbra, furnished the root meristems, the only material we have used in our observations. Unfortunately, we have not succeeded in obtaining floral buds which would permit a study of meiosis.

The root meristems (root tips) have been fixed in Navashin's fluid (Brunn's modification), La Cour 2BE and Flemming-Benda. For studying the number and morphology of the chromosomes we have used transverse sections, 20 microns in thickness. Staining was with gentian violet or iron-hematoxylin.

Longitudinal sections, of varying thickness between 15 and 20 microns, have been used particularly with the aim of determining the number of primary nucleoli. Staining of these sections has been accomplished by means of the safranin-light green technique, which gives good results.

¹ Our warm thanks are due M. Prof. P. Font Quer, to whom we are extremely obliged for obtaining the bulbs of *Tapeinanthus humilis* Herb.

OBSERVATIONS

Examination of numerous equatorial plates permits us to state that *Tapeinanthus humilis* possesses 28 somatic chromosomes (fig. 1a). Careful analysis of these plates has led us to establish the existence of the following chromosomes types (fig. 1a);

1.—Four chromosomes Lm, Having the arm L, beside a short arm indicated by the same symbol as in the other long types. The short arm has a secondary constriction, situated from the centromere a distance that is little more than equal to one-third the length of this same arm;

2.—Two pairs 'Lp₁, a short arm besides the long one similar to other chromosomes of the same type; the long arm presents a sub-median secondary constriction and is provided with a satellite at its distal extremity;

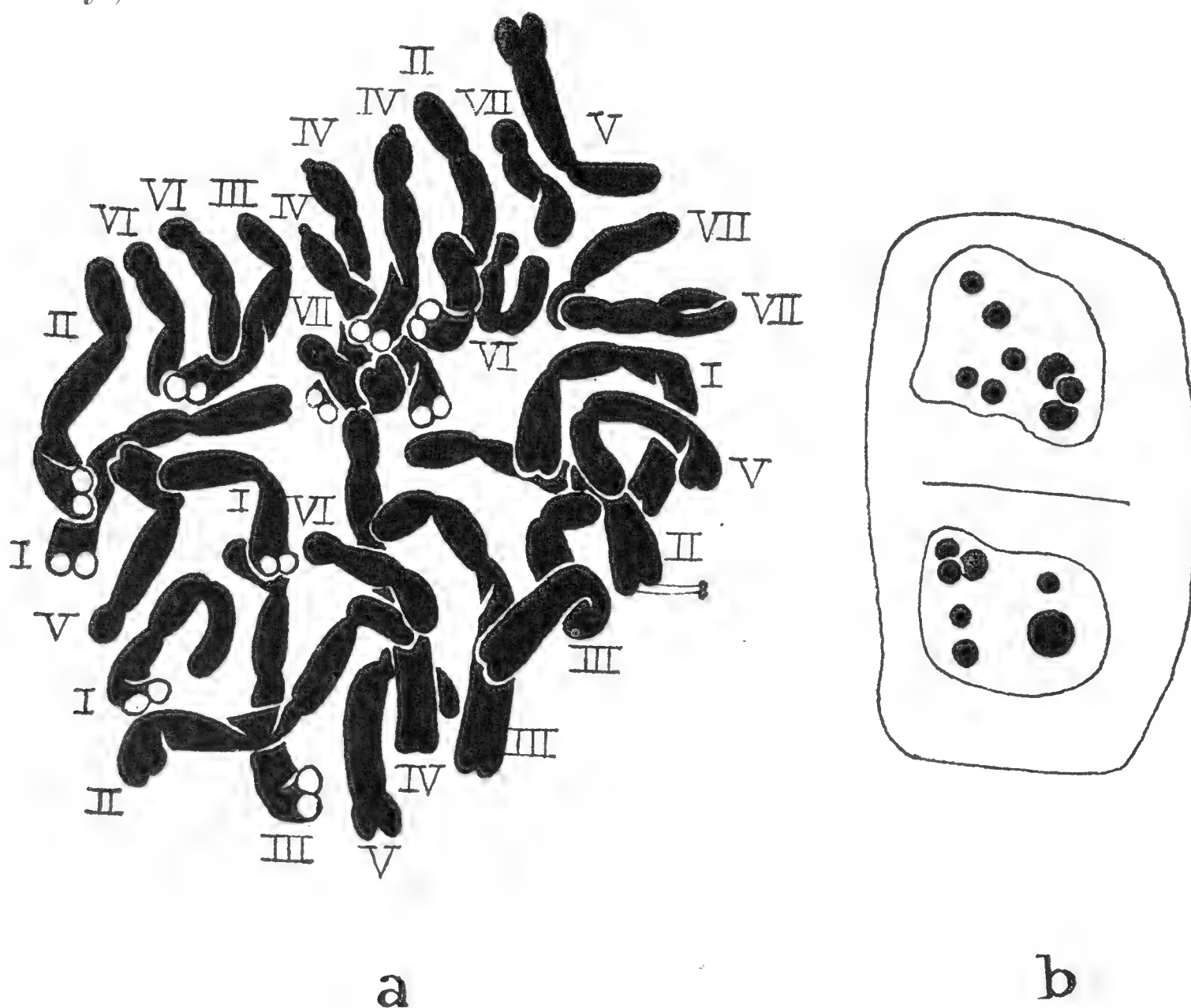


Fig. 1.—*Tapeinanthus humilis* Herb. a, Equatorial plate in a cell of the root tip. Explanation in the text. Navashin-gentian violet. X 3250. B, A stage a little in advance of telophase, showing 8 nucleoli in one half; the other half shows 7; resulting from the fusion of two of them. La Cour 2BE—safarnin-light green. X 2000.

3.—Four chromosomes Lp₂, the short arm is less long, than the short arm of type Lp₁; the long arm is provided with a secondary constriction, located about one-third the distance from the centromere;

4.—Two pairs of satellited chromosomes, Lp'₃, showing the same characteristics as the above type, but with the short arm a little less long and provided with satellites;

5.—Two pairs, li with the long arm l having a sub-terminal secondary constriction;

6.—Four short, almost isobrachial chromosomes Pp; the arm, P, is provided with a sub-terminal secondary constriction.

7.—Two pairs of cephalobrachial chromosomes P.

The determination of the primary number of nucleoli (Heitz, 1931) in the first stage of telophase has not been easy. Nevertheless, after careful observation we have succeeded in counting 8 in some figures, (figs. 1b and 2a). The maximum number of these bodies found in interphase nuclei has been 7 (fig. 2b), this also demonstrates that the primary number should be 8. Four of these elements are proximal and four are distal (fig. 2a). The first correspond to the four satellited

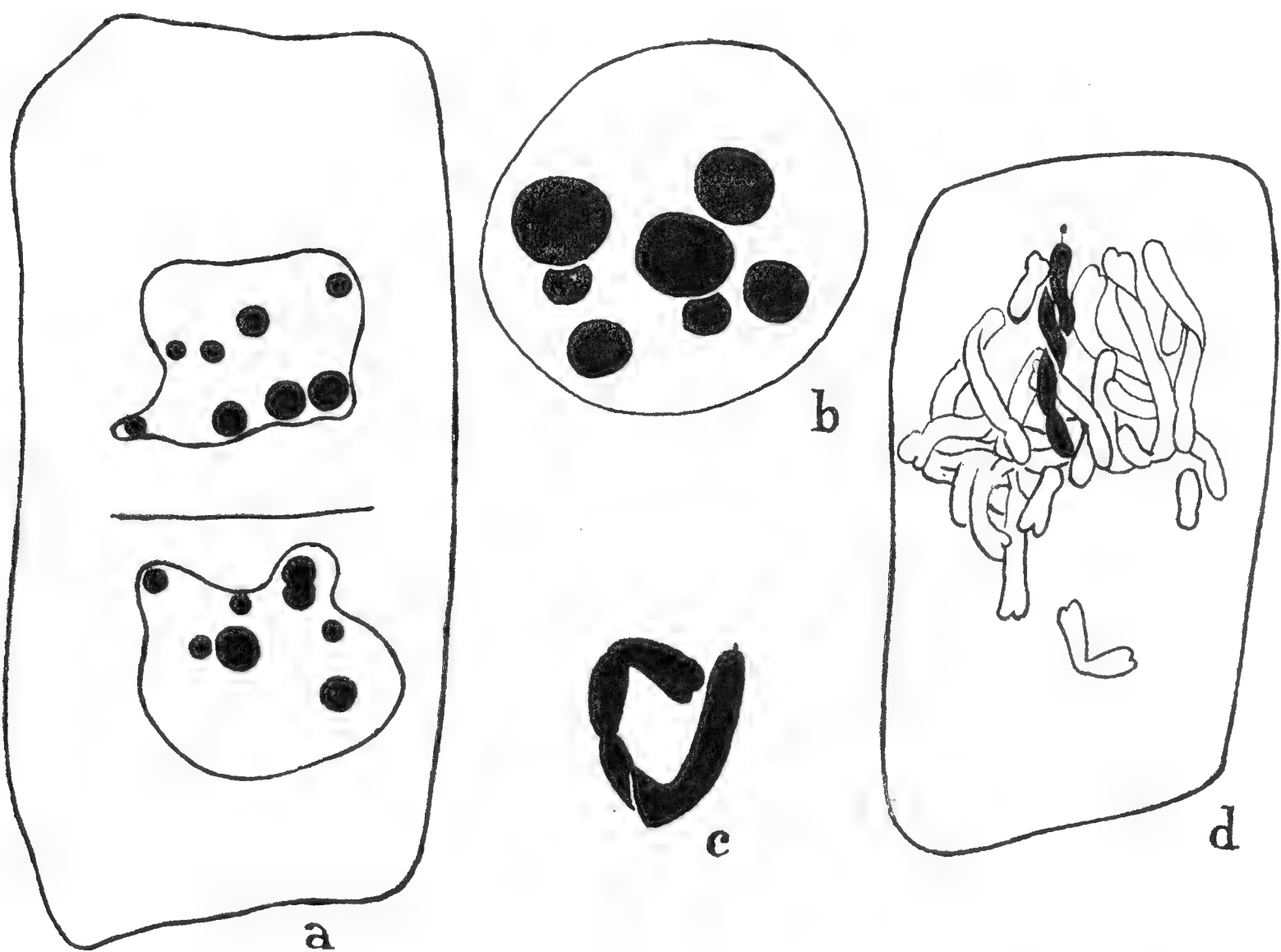


Fig. 2.—*Tapeinanthus humilis* Herb. *a*. One of the first stages of telophase, showing in a sufficiently clear fashion that 4 nucleoli are proximal and the other 4 are distal. La Cour 2BE-safranin-light green. X 2000. *b*, Interphase nucleus of a root tip meristem showing 7 nucleoli. *idem*. X 3250. *c*, Chromosome LP₁, showing a rather small satellite at the distal extremity of the long arm. Navashin-gentian violet. X 3250. *d*, a profile view of metaphase showing one satellite at the distal extremity of the long arm of chromosome LP₁. La Cour 2BE safranin-light green. X 2000.

chromosomes Lp'₃, while the distal ones correspond with the satellites situated at the extremities of the long arm of the four chromosomes Lp. An analysis of a great many figures has permitted us, in effect, to verify the existence of satellites occupying the expected position. However, from the fact that they are extremely small, they have been observed rather rarely, but we have found figures showing some of these elements

(figs. 1*a*, 2*c*, and 2*d*). In spite of this, it is very probable that four exist, and that we have not succeeded in identifying all four in the same figure because of their minute size.

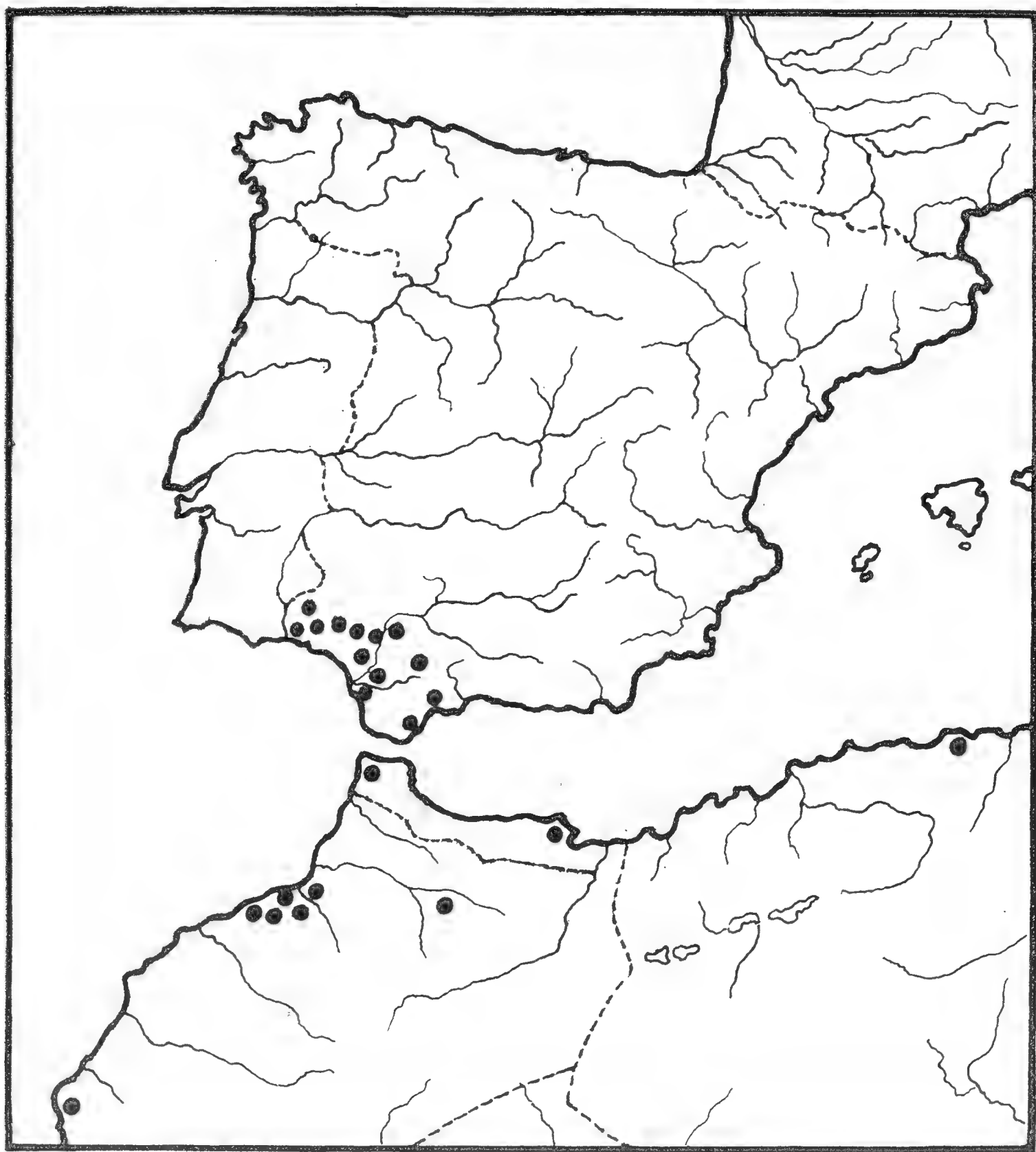


Fig. 3.—Map representing the geographic distribution of *Tapeinanthus humilis* Herb.

The figures where we have shown the satellites as being distal, with the exception of fig. 1*a*, are profile views of metaphase and anaphase, are inadequate as we know, to identify these types of chromosomes. The figs. 1*a*, 2*c* and 2*d*, however, permit us to state that the chromosome with the distal satellite belongs to the type Lp_1 . We believe, therefore, in the existence of two pairs $'Lp_1$.

According to the description of the morphology of the chromosomes that we have given, the idiogram of *Tapeinanthus humilis* Herb. can be represented by the following formula: $2n=28=4:Lm+4:'Lp_1+4:Lp_2+4:Lp'_3+4:li+4:Pp+4:P$.

From the fact that there are 7 different types of chromosomes, and that each is found represented four times, the formula shows immediately that *Tapeinanthus humilis* Herb. is a tetraploid form with a $n=7$ ancestor.

GEOGRAPHIC DISTRIBUTION

Tapeinanthus humilis Herb. presents a geographic distribution comparable with that of some of the species of the genus *Narcissus*, as shown by the map of fig. 3, compiled from the following list of localities from which this plant has been collected:

Spain: Andalusia: All the region of Huelva (between Cartaya, Gibráleon and Huelva; the environs of Niebla, Vilarassa and Palma); Jerez de la Frontera; Puerto de Santa Maria; between Puerto de Santa Maria and Buena-Vista; Cadiz; the lower course of the Guadalquivir; the environs of Sanlúcar la Mayor and Castilleja; the environs of Seville; Moron: Gibraltar. Grenade: Sierra del Hacho de Gaucin.

Spanish Morocco: the environs of Tangier; Melilla; the slopes of Mt. Gourougou.

French Morocco; at the seashore near Rabat; the valley of the Oued Korifla, near the N'Keila; Bouznike; all the valley of the Nefifik, on schist, on the side of Ben Nahet; the valley of the Oued Mellah at Sidi Larbi, in black clay on the road from Casablanca to Boulhaut: Cape Ghir; from Fès to Sefrou.

Algeria: at the foot of Chenoua, between Marengo and Tipaza.

DISCUSSION

Assuming that the flower of *Tapeinanthus humilis* possesses a short tube and a rudimentary corona one would expect this species to be a primitive form of the sub-tribe *Narcissinae*. The karyologic observations, however, show that the chromosome complement is composed of 7 different chromosome types, each of which is found repeated four times. *Tapeinanthus humilis* is therefore a tetraploid with a basic chromosome number of 7, and cannot be considered as primitive.

Since we are concerned with the systematic position of *Tapeinanthus humilis* Herb; the opinion of other writers is pertinent. Thus, Cavanilles (1794) placed it in *Pancratium* and in this opinion has been followed by Willdenow (1799), Persoon (1805), Ker-Gawler (1817), Sprengel (1825) and Schultz (1830)—for bibliographic references see Gay, 1858. Schousbøe (1800) classed it among *Amaryllis*. Herbert (1821, 1837), Ker-Gawler (1822), Sprengel (1827), Schultz (1830), Roemer (1847), and Knuth (1850)—for bibliographic references see also Gay, 1858—have reported it in the section *Sternbergiae* of the tribe *Amaryllideae*. Boissier (1839-1845), who named the genus *Carregnoa*, said that it belonged on the tribe Amaryllées rather than Narcissées (“devra se classer plutôt dans la tribu des Amaryllées que dans celle des Narcissées”). Baker (citation of Baker, 1888) reports it in the genus *Lapiedra*. Gay, (1858), emphasizing the errors and confusion of these writers, expressed the opinion that *Tapeinanthus* (*Carregnoa*) *humilis* should be placed in the tribe Narcissées (the group which, in this

author's scheme, corresponds to the sub-tribe *Narcissinae* Link). This point of view has been followed by subsequent investigators (Baker, 1888; Pax and Hoffmann, 1930).

The observations of Fernandes (see especially 1943) have shown that the basic, primitive chromosome number of the genus *Narcissus* is 7. The existence of the same number in *Tapeinanthus* leads to the conclusion that these two genera present a close relationship. The same conclusion is confirmed by the fact that the chromosome types existing in *Tapeinanthus* resemble those of some of the species of *Narcissus*. Consequently, *Tapeinanthus* should have been included in the sub-tribe *Narcissinae*, in close association with the genus *Narcissus*, in accordance with the ideas of Gay (1858), Baker (1888), and Pax and Hoffmann (1930).

Comparison of the idiogram of *Tapeinanthus humilis* with the idiograms of some of the species of *Narcissus* permits us to establish the relationship existing between the two genera in a more precise fashion. In previous work, Fernandes (1939 *a*, 1939 *b*) it was ascertained that *Narcissus gaditanus* Boiss. and Reut. possessed 14 somatic chromosomes whose morphological characteristics could be represented by the following formula (fig. 4*a*) :

$$2n=14=2:Lm+2:Lp_1+2:Lp_2+2:Lp'_3+2:li+2:Pp+2:P.$$

Careful comparison of this idiogram with that of *T. humilis* shows that the last corresponds to a duplication of the first.

$$2n=28=4:Lm+4:Lp_1+4:Lp_2+4:Lp'_3+4:li+4:Pp+4:P.$$

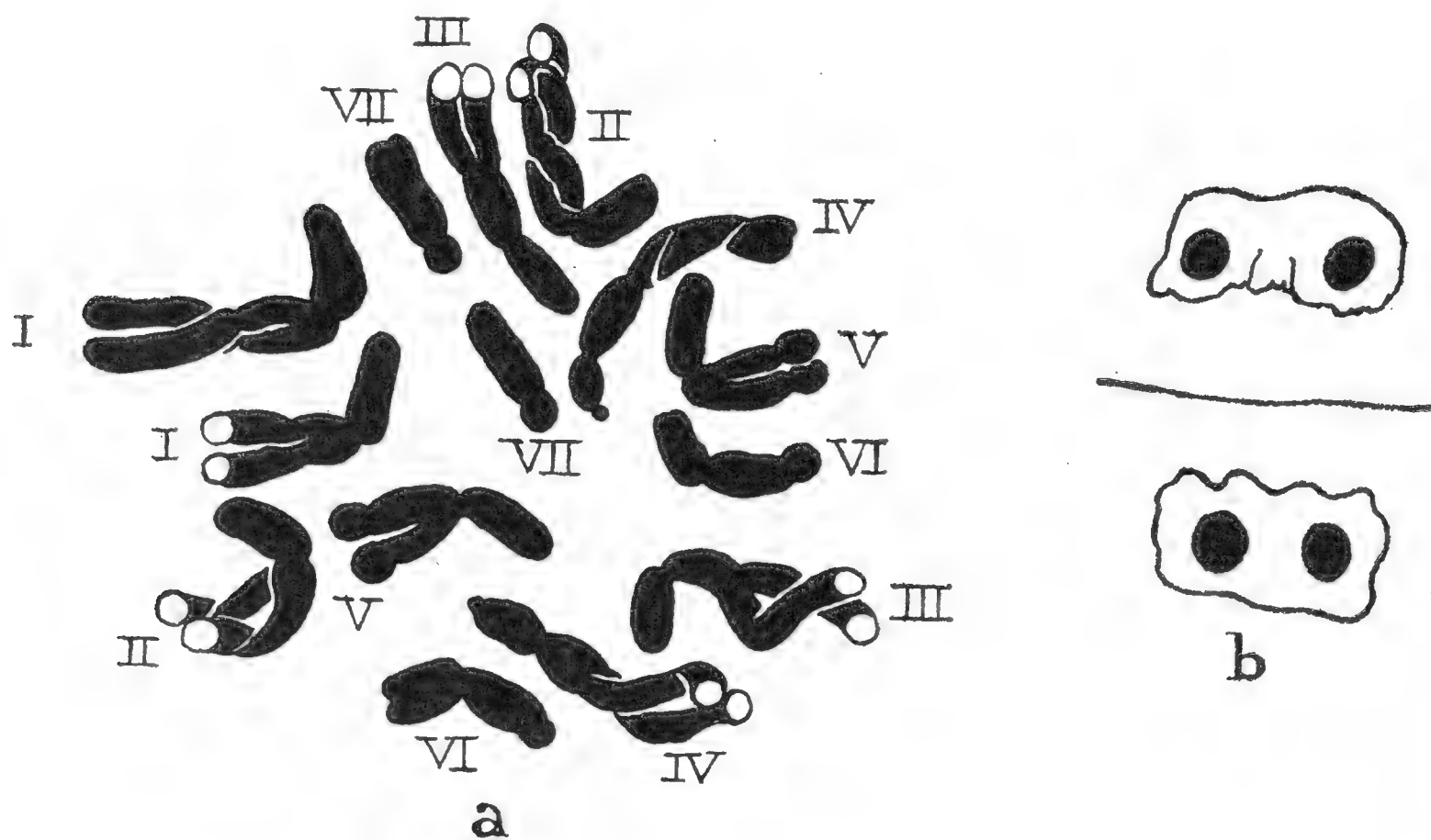


Fig. 4.—*Narcissus gaditanus* Boiss. and Reut. *a*, Equatorial plate in the cell of a root tip. Navashin-gentian violet. X 3250. *b*, The first stage of telophase in a root tip cell showing two nucleoli. La Cour 2BE-safranin light green. X 2200.

The only difference that we have found concerns the existence in *T. humilis* of satellites at the distal extremities of the arm of the chromo-

somes Lp_1 , while in *N. gaditanus* these chromosomes are devoid of satellites. One cannot attribute importance to this difference, since some observations made with *N. Bulbocodium* L. (Fernandes and Neves, 1941) have shown that in this species there is great polymorphism from the point of view of the satellites (and consequently in the nucleoli) among the diploid population. In fact, diploid populations having the following constitution have been found: $2Pp'$ (two nucleoli), $2'Lp + 2Pp'$ (four nucleoli), and $4'Lp$ (four nucleoli). As this phenomena occurs in *N. Bulbocodium* L., it would also occur in *N. gaditanus* or its ancestor, for this reason diploid populations provided with four satellites (two proximal and two distal) can be said to exist. The complement of *T. humilis*, therefore, corresponds to a duplication of another, possessing $2'Lp_1$ and $2Lp'_3$. It acts as a second case comparable with that reported for *N. Bulbocodium* L.

According to these facts, it seems that we can conclude that *T. humilis* has been produced by chromosomal duplication in part from *N. gaditanus*, or more probably, as the facts of external morphology and geographic distribution indicate, in part from a common ancestor from which *N. gaditanus* also originated.

Several external morphological characters seem to be in harmony with the idea of considering *T. humilis* as a tetraploid form of an ancestor that also produced *N. gaditanus*. Thus, the two species possess comparable bulbs, filiform leaves, floral scape-cylindrical, slender and flexuous, similar spathes, yellow odoriferous flowers and stamens arranged in two ranks.

However, the differences are sharp enough, as is shown by the following table:

<i>N. gaditanus</i> Boiss and Reut.	<i>T. humilis</i> Herb.
Spring flowering	Autumn flowering
Perianth tube long	Tube shorter
Corona long	Corona rudimentary
Divisions of the perianth oval-lanceolate, needle-like.	Divisions of the perianth oblong-lanceolate, obtuse.

The first difference cannot be considered as militating against our hypothesis, for the reason that there are several species of *Narcissus* (*N. elegans*, *N. viridiflorous* and *N. serotinus*) which, as *Tapeinanthus*, have autumnal flowering. This type of flowering can even be a consequence of tetraploidy. In fact, several investigators (see Müntzing, 1936) have stated that polyploid forms develop more slowly and flower later than their diploid ancestors. Ernst (1941) in studies of *Antirrhinum majus*, states that the diploid plants of a certain race are "tag-neutrales" (neutral day), while the tetraploids behave as long day plants. In this fashion, polyploidy can lead to physiologic conditions susceptible to altering the flowering cycle of plants, and tetraploidy has, in our case, probably been the cause of the conversion of the plant from spring flowering to an autumn flowering one. In support of this

point, we can cite the fact that all species of *Narcissus* blooming in autumn are polyploids: *N. elegans* (hypertriploid), *N. viridiflorus* (tetraploid) and *N. serotinus* (hypertetraploid).

The second difference concerns a very important character. An analysis of the species of the genus *Narcissus* show, however, that the flower of *N. Pseudo-Narcissus* is provided with a long tube, while there is considerable resemblance between it and *N. cyclamineus* from the point of view of morphology and karyology. The flower of the latter species has no tube or a very short one (3 mm. maximum). For this reason, the difference in the length of the tube cannot be considered as a decisive argument against the hypothesis. Moreover, it needs to be said that among the forms of *N. gaditanus* one finds *N. minutiflorus* Willk. whose flower is provided with a relatively short tube (8-10 mm.).

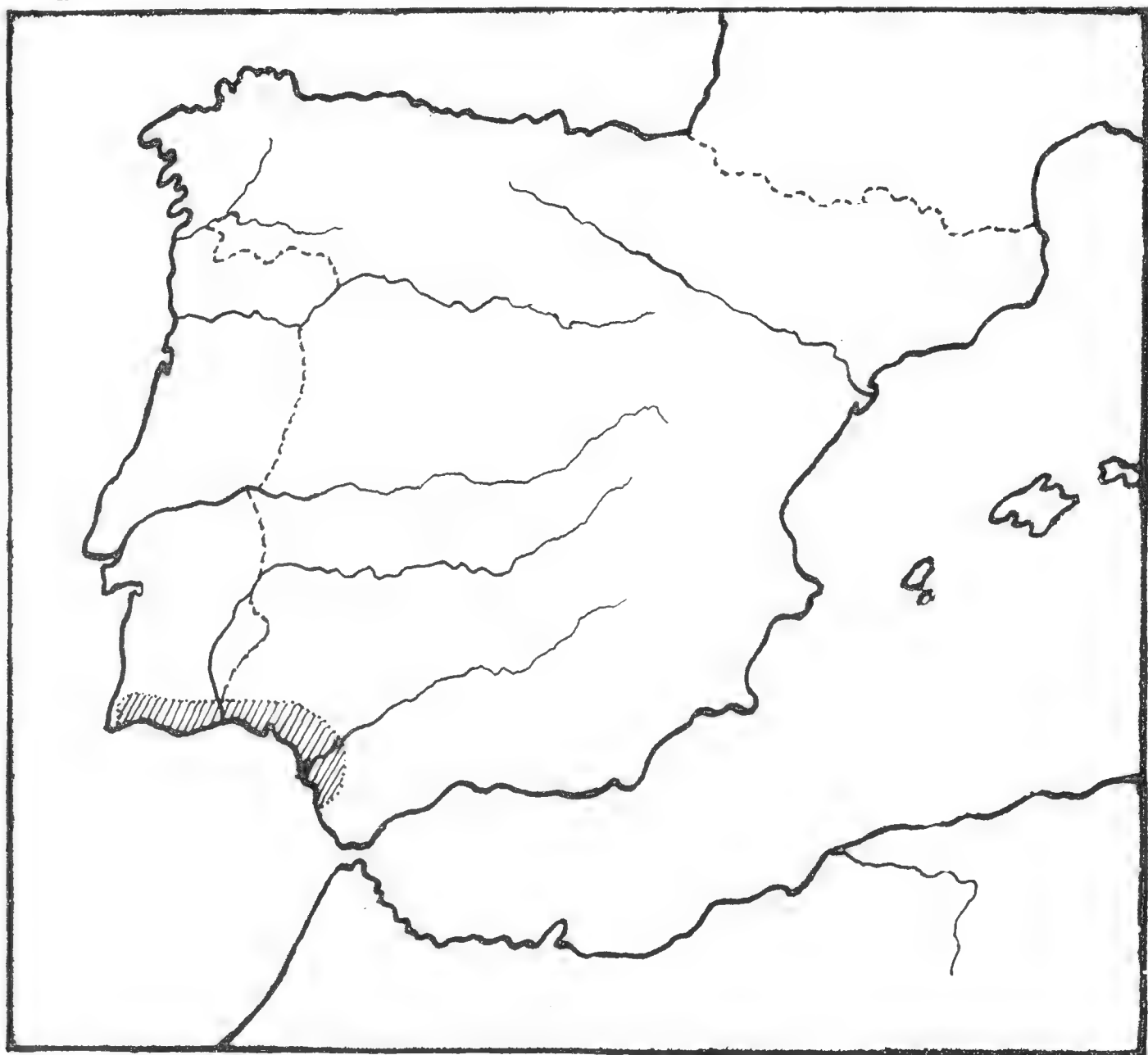


Fig. 5.—Geographic distribution of *N. gaditanus* Boiss and Reut.

The importance of the third difference is greatly diminished by the fact that we know that some species of *Narcissus* have almost no corona (*N. Broussonetii*) or little developed (*N. serotinus*). It is quite probable that the ancestor of the genus *Narcissus*, had flowers with a rudimentary corona. In this manner we can infer that in some species of *Narcissus*, likewise in *T. humilis*, the primitive condition has been conserved. However, it should be stated that all species of the genus *Narcissus* where the corona is poorly developed are polyploids like *T. humilis*.

Concerning the divisions of the perianth, it can be said that they are sharply differentiated. However, it should be noted that *N. sero-*

tinus also has oblanceolate-obtuse divisions of the perianth, recalling those of *T. humilis*.

According to what we have shown, we believe it can be concluded that an analysis of the external morphological characters is not opposed to the idea of considering *T. humilis* as a tetraploid form, derived from a common ancestor of this species and *N. gaditanus*.

The maps of figs. 3 and 5 show the geographic distribution of *T. humilis* and *N. gaditanus* respectively. One notes that *N. gaditanus* occupies only the Atlantic region of the southern part of the Iberian peninsula, while *T. humilis* occupies a larger area comprising: 1) the region of southern Spain between Malaga and Huelva; 2) the coastal zone of the Mediterranean of North Africa from Tangier as far as Algeria; 3) the Atlantic region of Morocco from Tangier as far as Cape Ghir.

The data of geographic distribution are in harmony with the hypothesis we have suggested. The fact that the two species have overlapping distributions in the region approximately between Gibraltar and Huelva supports the hypothesis.

According to the facts of geographic distribution we can retrace the probable history of *N. gaditanus* and *T. humilis* in the following manner:— At the entrance of the straits of Gibraltar, the ancestral form provided with 14 somatic chromosomes, arrived in the littoral region of southern Spain. In this region, it (the ancestral form) produced *N. gaditanus*, which made its way towards the west, following a route close to the sea and reaching almost to Cape Sao Vicente. In the same region the ancestral form produced a tetraploid, which because of tetraploidy became autumn flowering. This entity constituted the species *T. humilis*. From the fact that the new species was a more vigorous form and provided with a greater capacity for adaptation, (see Fernandes and Neves, 1941), it spread more rapidly than the diploid form, and advanced by its side, (the diploid) towards the West, at the same time it traversed the connection between Spain and Africa, and succeeded in establishing itself on the latter continent.

In southern Spain probably near the opening of the Straits of Gibraltar, *T. humilis* advanced toward the west and arrived at the frontiers of Portugal. In Africa, it advanced on one side toward the east, following the coastal Mediterranean zone to the vicinity of Algeria. In the other direction it progressed toward the south occupying the Atlantic region of Morocco as far as Cape Ghir. At the same time it also advanced toward the interior as is attested by its appearance between Fés and Sefrou.

The reason that *T. humilis* succeeded in occupying a larger area than *N. gaditanus* can be explained by the fact that the latter species, being a residual diploid, did not acquire the capacity for adaptation which would permit it to endure conditions of life in African regions.

On October 14, 1835, Perez Lara² collected a remarkable plant which he sent to Willkomm in 1880. After examining the flower, the

² Lara's description in Latin of the location of his find follows: "in pratis adjacentibus sanctuario dicto del Mimbral urbis Jere de la Frontera."

latter writer came to the conclusion that the plant belonged to the genus *Carregnoa* Boiss (—*Tapeinanthus* Herb.). In accordance with this opinion, Perez Lara described this new species later, in 1882, under the name *Carregnoa dubia*. Willkomm (1881-1885) gives a description of this plant emphasizing the differences existing between it and *Tapeinanthus* (*Carregnoa*) *humilis* and presenting a beautiful plate. Although, he considered it as new species of the genus *Carregnoa* (*Tapeinanthus*), he noticed that *Carregnoa dubia* was intermediate between *N. serotinus* and *T. humilis*, and for this reason, he asked if the new species could not be a hybrid of *N. serotinus* and *T. humilis*. However, after considering the characters of the floral scape, he was led to a rejection of this conclusion.

Janka (citation of Baker, 1888), Baker (1888) and Pax and Hoffmann (1930) believed that *Carregnoa dubia* was not a form of *N. serotinus*.

Placed with the articulation of the floral scape which he considered with reason to be the result of, "uneven shrinkage in drying," Bowles (1934) believed that *Carregnoa dubia* was a hybrid of *N. serotinus* and *T. humilis*, since, "certain of its characters are intermediate between the two genera, particularly the longer perianth tube and the stamens projecting less from the throat than in *Tapeinanthus*, also the whiter flower and rather larger coronal scales." (Bowles, 1934, p. 36). In his analysis of the plate of Willkomm (1881-1885) we share the opinion of Bowles, and we consider his opinion as probably the correct one. The genus *Tapeinanthus* is therefore monotypic, composed only of the species *T. humilis* Herb. The appearance of a hybrid of *N. serotinus* and *T. humilis* is further evidence of the close affinity existing between the two genera.

SUMMARY

1. *Tapeinanthus humilis* has an idiogram which can be represented by the following formula:

$$2n = 28 = 4 : Lm + 4 : 'Lp_1 + 4 : Lp_2 + 4 : Lp'_3 + 4 : li + 4 : Pp + 4 : P.$$

Given that the chromosome complement is composed of 7 different types, each of which is found repeated four times, this species is a tetraploid form, derived from an ancestor with the basic number 7.

2. From the fact that one finds in *Tapeinanthus* the same base number and the same chromosome types that are characteristic of some of the species of the genus *Narcissus*, *Tapeinanthus* should be considered as belonging to the tribe *Narcisseae* (sub-tribe *Narcissineae*) and not to the tribe *Amaryllideae*.

3. Comparison of the idiogram of *T. humilis* with that of *N. gaditanus* shows that the first corresponds to a duplication of the second. In accordance with this fact, it is suggested that *T. humilis* has been produced by chromosomal duplication in part from a common ancestor of this species and *N. gaditanus*. If this hypothesis is correct, we can say that tetraploidy, probably associated with alterations in the struc-

ture of the chromosomes, and with gene mutations, has been capable of producing a new genus.

4. The data of external morphology and of geographic distribution are in accord with this hypothesis.

5. On the basis of the data of geographic distribution, we have retraced the probable history of *T. humilis*.

6. The plant known under the name *Carregnoa dubia* Perez Lara, should, in accordance with the opinion of Bowles, be considered as a hybrid of *N. serotinus* and *Tapeinanthus humilis*. The appearance of this plant reinforces the idea that there exists a great affinity between the genera *Narcissus* and *Tapeinanthus*.

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REGISTRATION OF NEW AMARYLLID CLONES

Descriptions of new clones of hybrid amaryllids for this section should reach the editor by September 1 if at all possible. Information sent after that date may be held over to the next issue if space is not available. This information is published to avoid duplication of names, and to provide a place for authentic recording of *brief* descriptions. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used.

At present there is a limit to the number of descriptions included from any one member. Not more than five brief descriptions of clones under each generic heading will be published free of charge from any one member in any issue of HERBERTIA. Additional descriptions will be published in the advertising section at regular ad rates. The first five descriptions will appear in this section and the excess will be continued in the section entitled, "Buyers Guide."

HYBRID DAYLILY (HEMEROCALLIS) CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.*; (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.*, (3)

Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.; (4) Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.; (5) Texas Agricultural Experiment Station, Dept. of Horticulture, College Station, Texas; and (6) Des Moines Park Board, Des Moines, Iowa. [Complete addresses are given under Officers and Committees, below.]

Introducers should send complete collections of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.



Fig. 142. Plant of *Selina Foster* Daylily. Photo by Paul A. Kane

Introduced by Mr. & Mrs. Eugene A. Taylor, Sharon, Mass.

Ruby Taylor. (*Cissy Guiseppi* X orange seedling) 42" high; 20 fls. per scape; flowers 4 $\frac{1}{4}$ " in diam., ruby red, slightly deeper eye-zone, light green throat; July 12 to Aug. 28.

Quaker Maid. (*Sunny West* X *Ruby Taylor*) 3 $\frac{1}{2}$ ft. high; 38 fls. per scape; flowers 4" in diam., petals lavender, sepals fulvous; fulvous eye-zone, yellow throat; mid-ribs light cream; pleasant fragrance; July 17 to Aug. 28.

Straw Bonnet. 39" high; 17 fls. per scape; flowers 4½" in diam., straw, veined red, eye-zone deep orange red, light green throat; pleasant fragrance; July 10 to Aug. 27.

Highland Lassie. 48" high; 32 fls. per scape; flowers 5" in diam., deep orange, veined red, faint orange red eye-zone, light green throat; July 22 to Sept. 26.

Introduced by Mrs. Paul A. Kane, San Antonio, Texas.

Selina Foster. (Mrs. A. H. Austin X *H. minor*) (Figs. 142 and 150). Up to 48 fls. per scape; flowers 4½" in diam.; Sunflower (M & P, 9-L-4); up to 6 fls. open at one time; recurrent bloomer in Texas.

Introduced by Stanley E. Saxton, Saxton Gardens, Mount Arab, N. Y.

Ileen. Robust plant 38" tall. Flower 5½" to 6½", petals 1½" peach bronze with dusty-rose eye. Sepals 1" slightly lighter with faint dusting at eye zone. Well branched, petals somewhat spatulate and ruffled. Intermediate bloomer, June and July.

Sugar Plum. Medium tall 30". Large flower 5½" to 6½", plum purple self. Petals wide and pointed, somewhat trumpet shaped. Throat greenish yellow, small. There is a bluish sheen to the purple. Good branching, July and August.

Candy Stick. Medium tall 34". Large Flower 5" to 5½". Petals 1⅜" flag red, veined deeper, ruffled and slightly twisted. Sepals 1" flushed lighter shade of the same red. Effect bi-tone. July and August.

Sweet Sue. A trim, symmetrical bicolor; petals bright pink, sepals frosted canary yellow; segments are pointed not recurved. Stems tall, flowers medium in size; throat golden and outlined with deep rose.

Blondie. A very light pastel flower in tones of light pink and yellow. Petals pink, ruffled and recurved gracefully. A deeper eye marking adds contrast. Sepals light yellow.

Introduced by James C. Stevens, Greenville, N. Y.

Normandie. Height 30 in.; flowers 18 to 20, approx. 4½ in. in diam.; Terra Cotta, flushed rose, lemon throat; late midseason.

Peter Pan. *Bijou* X *Baghdad*. Height 23 in.; bright red, orange throat, indistinct eye-zone; flowers small, 15 to 20 flowers per scape; fades slightly in late afternoon; midseason.

Zanzibar. *Bijou* X *Bagdad*, F-2. Height 30 in.; dark brown-red, orange-green throat, slight eye-zone; 15 to 20 flowers per scape; flowers 5 in. in diam., lasting well into the evening; late midseason.

Brigadier, *Festival* X *Wolof*. Height 30 in.; metallic red petals, orange, flushed red sepals, slight eye-zone; 18 to 20 flowers per scape; flowers nicely formed, 5 in. in diam.; late midseason.

Introduced by Mrs. Bright Taylor, Ocala, Florida.

Cluny Brown. Bicolor; Petals brown with yellow midrib; sepals yellow. Wide yellow throat. Form, full, regular; substance, heavy; texture, smooth. Scapes, many branched, stiffly erect, 30 inches. Ever-

green foliage. Early. Sun resistant. Extended blooming. Good seed parent. Showy garden type.

Prima Donna. Centric; semi two-toned. In habit of growth, rate of increase, evergreen foliage, flower form and size, the resemblance to *H. aurantiaca* major is marked. In color, the throat of the flower is near daffodill—(Maerz & Paul, *A Dictionary of Color*. Plate 10-J-6); the petals and sepals, near ember red (Plate 5-J-10); the midrib, near corn-husk (Plate 10-G-6). However, the throat color comes up on the petals

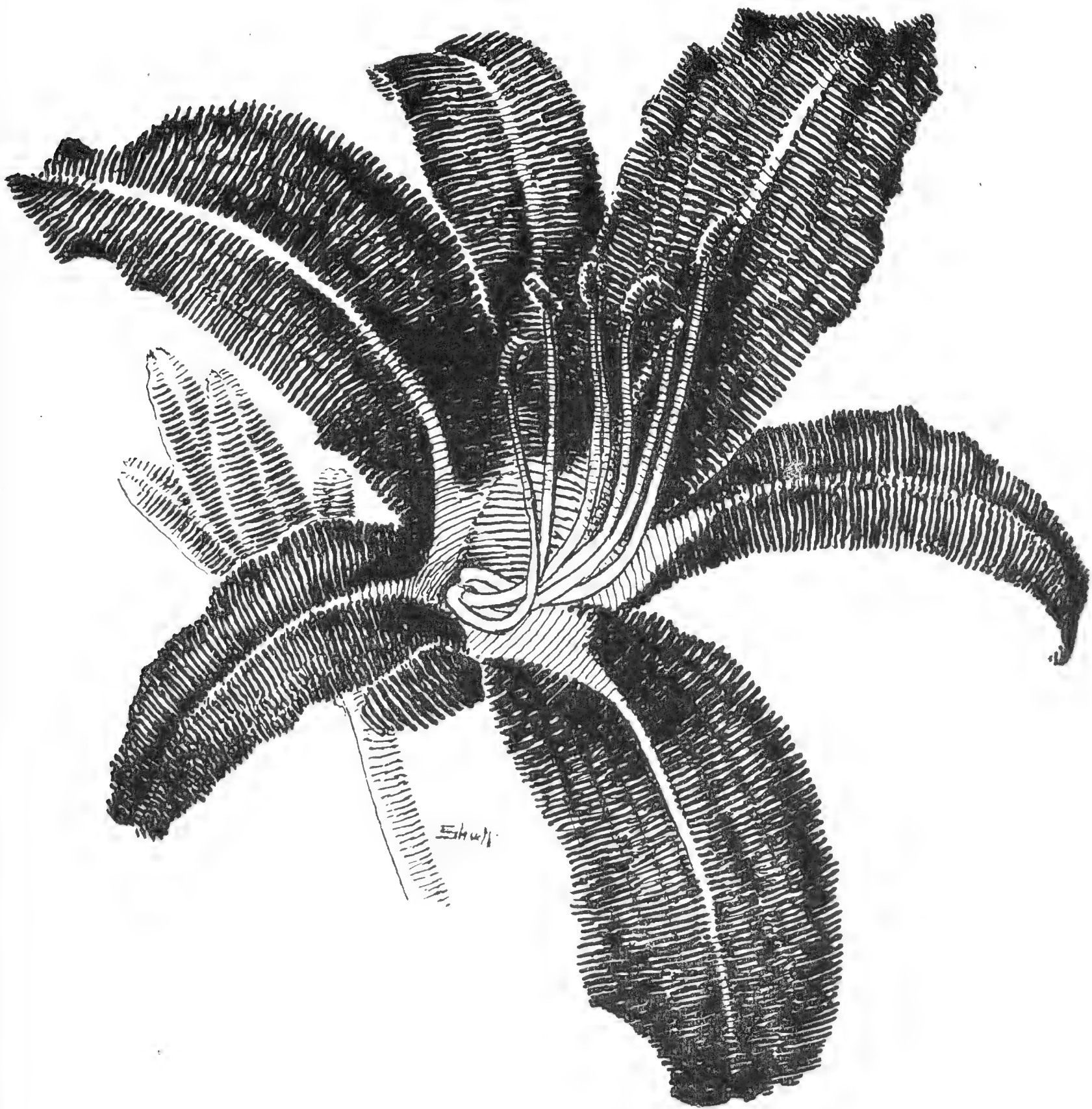


Fig. 143. Hybrid Daylily—*Color Guard*. Photo by J. Marion Shull.

and sepals in a convex arch, diffusing and diluting the colors, so that the garden effect is peach in a semi two toned design. The substance is excellent, texture rather smooth, height of scapes, which are many branching, 2½ to 3 feet; midseason bloomer. Good seed parent.

Introduced by J. Marion Shull, Chevy Chase, Maryland

Color Guard. (Figure 143). Practically a vermillion self, a red that does not fade or burn in the sun nor spot in rain. The general self effect is further enhanced by the smallness of the throat area, which is orange in close harmony rather than contrast with the surrounding red. Height about three feet. July bloomer at Washington.



Fig. 144. Hybrid Daylily—*Fluffy Ruffles*. Photo by J. Marion Shull.

Fluffy Ruffles. (Figure 144). Soft creamy light yellow with broad and very ruffled petals. Surface creped. Eye zone broad and diffused, warm russet. Sepals unmarked same color as petals with tips slightly recurved. Height three feet. July bloom.

Musette. (Figure 145). Description in *Herbertia*, Volume 7, page 132. Bright banana yellow. Very large. Distinctive star shape produced by oblanceolate petals.

Introduced by L. Ernest Plouf, Lawrence, Mass.

Tamarac Velvety bright red-maroon on all segments; deeper zone on outer; slight midrib; deeper veins; gold throat; fine triangular form; good substance.

Violet Purple 3ft. July-Aug. All segments very deep purple—deeper zone on inner; absolutely no midrib coloring; olive throat; long-tubed well open trumpet; round outline; inner segments embossed; suede finish; good substance; reverses deeply colored; purple buds; erect stem; keeps well very late; darkest of all in our planting.

Vipart 4ft. July-Aug. All segments bright pink-rose; no deeper zone; olive-yellow throat; inner segments well recurved with very pale midrib; outer segments stand erect; well open; keeps well.

Arabian Copper 4ft. July. All segments odd shade rich maroon copper; deep maroon zone; wide orange throat; full 4 inch flower; inner segments spatulate and crinkled at edges; outer segments embossed; chamois finish; round outline; well open; fine form; good erect stem; keeps well.

Desert Sunset 4ft. July-Aug. All segments rich bright deep crimson-red; orange throat; full inch flower; excellent form and substance; chamois finish; good stem; keeps until dark; bright from a distance.

Introduced by Vivian Christenson, Marcus, Iowa.

Raspberry Revel. Seedling x *F. rosea*; segments Yucatan with a star of brilliant De Medici purple that blends into the Yucatan coloring throat Chartreuse Yellow; 40".

Chetkins. *Ophir* x *F. rosea*; flowers brilliant copper self produced by deep golden-glow yellow smoothly burnished rufous orange; tiny throat of deep golden-glow; 50".

Rose Reverie. *Soudan* x *F. rosea*; a rose (pastel) self with thin cream line around segments; 5 ft.

Originated by Dr. A. B. Stout, New York Botanical Garden.

For descriptions of the following named clones, the reader is directed to the Journal of the New York Botanical Garden 47:77-82.1946.—*August Orange, Blanche Hooker, Caprice, Fantasia, Fiftieth Anniversary, Firebrand, Georgia, Manchu, Rose Gem, and Viking.*

Introduced by Ralph W. Wheeler, Winter Park, Florida

Billie Burke. A bicolor with purple maroon frilled and creped petals while the sepals and throat are bright canary yellow. Also there are wide yellow bands through the midrib of the petals. The flower is large and well open on thirty inch stems. A semi-night bloomer.

Cellini. A specimen flower of great beauty of form. The color is sulphur yellow. Compact, shallow throat, very wide segments, well open but flaring to slightly recurved. The flower is large on three foot stems and opens in the evening, remaining open through the next day.

Haille Selassie. A very large, well open bicolor of deep, dull purple with orange throat and sepals, together with wide bands of orange along the midrib of the petals. The stems are three feet. The combination of orange and purple makes this a most striking Daylily.

Hazel Sawyer. This is a lavender pink Daylily of handsome form in rare coloring. The flowers are medium large to large on two foot stems, well open, petals frilled. It is vigorous, propagates freely, is a free bloomer and makes a beautiful garden subject. A recurrent bloomer in Florida.

Indian Maid. Rich and unusual coloring make this a striking and beautiful Daylily. It is very dark purple maroon with deepest purple eye zone. Surrounding the eye zone is a narrow orange halo which blends into the liquid green throat. The flower has roundly recurved segments, is medium large on three foot, multiflora stems which also carry proliferations. The first stem produced thirty-six flowers. It is remarkably resistant to full Florida sun, an unusual character in a dark colored Daylily.

Introduced by E. J. Kraus, Chicago, Illinois.

Felice. Height 40 inches. Leaves bright green, upright recurved. Scape erect, 3 to 5 branched, 25 to 35 flowered. Each flower regular, faces direct outward, wide spreading 6.5 inches, shed quickly, does not fade in sun. Petals 5 inches long 1.5 inches wide, pale cadmium, slightly lighter at edges with darker, slightly raised midvein. Margins waved, tips abruptly narrowed and recurved. Sepals 4.5 inches long, .75 inch wide, same coloring as petals, shading to picric yellow at base; two prominent longitudinal furrows extending throughout its length. Odorless. Heavy substance, does not fade in sun. Third week in July to September 1. Seedling of *Golden West* x *Quaker*.

Mendota. Height 40 inches. Leaves erect, deep green. Scape erect 3 to 5 branched 25 to 40 flowered, rising 5 to 6 inches above foliage mass. Each flower pointed slightly upward, shed quickly. Flower regular, long tubular, widely flaring, diameter 5 inches. Petals 1.5 inches wide 4 inches long, lemon yellow, light yellow mid veins, slightly ruffled. Sepals, 1 inch wide 4 inches long same color as petals. Faint, pleasing odor. Does not wilt or fade in sun. Very free blooming. Season early July to mid August. Seedling *Cressida* x *Sunny West*.

Midnight. Height 36 inches. Leaves wide, dark green, 18 to 24 inches, recurved at tip. Scape upright, 3 to 4 branched, 25 to 35 flowered, flowers borne 8 to 10 inches above foliage mass. Flower slightly pointed upward, tubular reflexed, 5 inches in diameter, segments overlapping, quick shedding. Petals 3 inches long 1.25 inches wide, broadly oval, distal two thirds deep maroon shading to garnet brown, narrow band of Brazil red at edges, indistinct very broad eye zone of victoria lake toned mars violet, remainder deep chrome. Sepals 3.25 inches long .75 inches broad, oval, slightly ruffled, distal fourth oxblood red toned garnet and brazil red, deep chrome basal portion. Stamens orange toned brazil red. Reverse of flower deep orange heavily shaded

garnet. General effect in sun dark purple black. Retains color without wilting in sun. Season July 10 to mid-September, recurrent free bloomer. Vigorous. Seedling of *Dominion* x unnamed seedling.

Monona. Height 20 inches. Leaves dark green, erect spreading, making compact bush. Scape heavy, 36 inches, strong upright sweeping in graceful curve, total height attained 24 to 30 inches, so that flowers are borne just above or at priphery of leaf mass, 3 to 4 branched, 25 to 40 flowers borne close together but well spaced. Flower tubular, full, widely flaring, 5.25 inches in diameter. Quick shedding. Petals 4 inches



Fig. 145. Hybrid Daylily—*Musette*. Photo by J. Marion Shull.

long 1.5 inches wide, pointed spatulate, pure deep orange, cadmium orange at base, brilliant, glistening. Sepals 3.5 inches long by 1 inch wide, same color as petals. Texture thick, waxy. Odorless. Does not fade in sun. Vigorous, free blooming. Season July 10 to August 20. Seedling of *Cressida* x *Rajah*.

Morello. Height 30 inches. Leaves erect, bright green, recurved at tips. Scape sturdy, 3 to 4 branched, 20 to 30 flowered rising slightly above foliage. Each flower 4.75 to 5 inches in diameter, tubular reflexed, segments overlapping, petals slightly folded back along midrib. Petals 3 inches long 1.25 inches wide. Distal half dark brazil red indistinctly veined garnet, broad garnet eye zone; remainder cadmium yellow, with cadmium mid vein brushed red toward outer portion. Sepals 3 inches long, .75 inches wide, distal two thirds brazil red over cadmium, remainder dark cadmium yellow. General effect bright glowing red in sun, color retained throughout the day. Odorless. Heavy texture. Season last week in July to September 1. Seedling of *Rajah* x unnamed red seedling.

Introduced by Hamilton P. Traub and J. S. Cooley.

Vivian Toole. Medium height; beautiful shade of Burnt Orange (RHS O-14/2) with reddish cast; flowers 5½ inches in diam.; mid-season.

Orient Pink. Height 3½ ft.; 19 or more flowers per scape; flowers 4½ inches in diam.; petaline segments near Orient Pink (RHS 4-16), with narrow yellow stripe in center; sepaline segments yellow, flushed Orient Pink; yellow throat; midseason; sun-resistant. (No. 800)

Cadmium Orange. Height 3 ft.; flowers 5 inches in diameter; beautiful clear Cadmium Orange (RHS 8) self; midseason; sun-resistant. (No. 801)

HYBRID AMARYLLIS CLONES

Introduced by Carrie M. Armstrong, Joy, Illinois.

Rose Marie. Leopoldii Type B, 9 inches across face; color American Beauty (pink), white throat, with a white stripe in center of segments extending about half way.

Dorathy May. Leopoldii Type B, 9 inches across face; color white, heavily bordered pink.

Karen Marlys. Leopoldii Type A, 9 inches across face; color white with red pencilings in throat.

Rex. Leopoldii Type B, 9 inches across face; color dark red, small light green star in center.

Betty Jean. Leopoldii Type B, 10 inches face, color white with pink pencilings in throat (Diener seedling).

Introduced by Mr. Garnald D. Zeiner, Lost Springs, Kansas.

Salmon Supreme. Leopoldi type B. Salmon colored, 6¾ inches in diam. across face.

Salmon Streak. Reginae type B. Salmon with white stripe down center of each segment; flowers 6 inches in diameter; excellent form.

Spot. Leopoldi type B. Pure white except for a few pink spots; flowers 7 inches in diam; fair form.

Sunset. Reginae type B. Orange with white stripe down center of segments; good form.

Watermelon. Leopoldi type A. Rose-red self; flowers 9 inches in diam.; fair form.

3. CYTOLOGY, GENETICS AND BREEDING

NOTES ON PINK NARCISSUS SEEDLINGS

C. E. BAILEY

[With the death of C. E. Bailey on April 25th of this year the American daffodil hybridizers have lost one of their outstanding colleagues. Charles E. Bailey was widely known in shipping circles as the Executive Secretary and General Manager of the Portland (Oregon) Commission of Public Docks. Less well known was the fact that he was one of the foremost contemporary daffodil breeders who, especially in the field of pink daffodils, had made great gains. Working alone and following his own theories he developed several strains of fine daffodils which, especially for breeding purposes, have definite merit. He also produced several excellent and early red and white Barrii and a number of pure white trumpet varieties.

To have seen Mr. Bailey at work in his small city garden, surrounded by a galaxy of magnificent pink and white daffodils, is something that will stay long in the memory of his friends and colleagues. Mr. Bailey died at the age of 59, just when his latest new seedlings were in flower. A few days before his death the first batch of seedlings from his favorite "pink" daffodil came into flower and from his bed he could see that definite success had crowned his long years of painstaking work.

During the past winter he had, at the request of our Secretary, jotted down some notes on his theories and methods. These notes, together with his "stud" books he bequeathed to me and from them I have selected the following paragraphs. Mr. Bailey expressed the desire that we carry on his work and in a few years I hope to be able to give a further report on the result of his work.—*Jan de Graaff, May 10, 1945.*]

NOTES BY C. E. BAILEY—1880 to 1945

As a fascinating hobby, I have spent much effort, time and study in attempting to produce a strain of daffodils in which the pink genes would be definitely dominant and would carry on through successive progeny. There have been some small rewards enough to lend encouragement, but not enough to permit over-enthusiastic conclusions. Flowering of the seedlings from the crossings of the last two or three years should prove—or discredit—many of my pet theories and my lines of procedure.

As for the source of "pink" every man to his own guess. As one of the English hybridizers has expressed it—"Pink, like gold, is where you find it." Seriously however, there is enough similarity of pattern in the many unexpected breaks reported from all parts of the world and there is sufficient other data available upon which to base the general, rather broad, primary premise that latent potentialities for pink exist to some degree in any hybrid daffodil in which there is even the remotest trace of *Narcissus poeticus* blood. In such a daffodil the pink genes are recessive and can become dominant in time with careful,

selective breeding. I am also of the opinion that, with a definite color strain fixed, improvement in form and size can best be obtained by cross-pollenizing with the finer and larger whites in which "absence of color" has become established. This is borne out by the results Wilson recently obtained from the use of *Broughshane* and by the "pinks" in the progeny of *Evening* as well as by the presence of pink in seedlings from pollen of *Carnlough*.

The potentialities for pink are apparently more dominant in the Leedsii and their borderline kin among the white Ajax, as evidenced by *Lord Kitchner*, *Mitylene* and *White Sentinel* in particular and by such others as *Gracious*, *Gertie Millar*, *Eskimo*, *Evening* and—from Wilson's recent reports—even *Broughshane*. So far as we know it is from these and possibly a few others of similar type that most of the known pinks have been derived either by cross pollenization or by selfing. I believe that the first pinks were obtained by chance or accident and not by design.

It should be noted that none of the above flowers in themselves give any visual evidence of pink with the exception possibly of *Eskimo*, which at times manifests a faint illusion of pink in the trumpet as it ages. It has been advanced with respect to several of the above varieties that their tendency to "throw" pink can be directly attributed to some specific ancestor such as *Weardale Perfection*, *Beacon* or *Princess Mary*. On the basis of my own experiments I feel that I cannot subscribe to these theories.

Laying aside for an instant all the science of genes, chromosomes, Mendelian laws and what have you—and laying myself wide open to the criticism of the learned—it has always seemed to me that the appearance of pink in daffodils could be likened to a simple formula of dilution. Just as the red in the fine new red-cupped hybrids has been brought up from the red of *N. poeticus* by mixing red with red and intensifying it—so has the red of *N. poeticus* been diluted, as it were, through many generations of crossing with whites until the red disappeared and pink—that is equal parts of red and white—appeared and finally became fixed.

In addition to this second premise, there is no doubt whatsoever in my own mind but what there must be many other varieties among the hundreds of existing Leedsii, which although undiscovered as yet, have equal or even more dominant potentialities for pink than the few varieties from which most of our present "pinks" are known to have been originated. It is my own observation that flowers which show no visual evidence of color often carry more dominant pink genes than those in which the color has become manifest. *Kenmare*, *Rose of Tralee* and *Dunloe* from *White Sentinel* selfed are illustrations.

This premise holds true, particularly, with selfed white off-spring from pink parents—my own finest pink being derived from the selfing of a fine white Leedsii without the faintest vestige of color, but the progeny of two pinks. I have discussed this with other hybridizers on a number of occasions and have, I believe, convinced them not to discard any whites of good form from known pink parentage. These should

be selfed or interbred back to either of the parents, preferably the pollen parent.

With the pink genes established or fixed as dominant, size, form and length of stem can, I believe, then best be obtained through crossing with the better whites of an established strain. In them, through years of breeding, absence of color has been obtained and has become fixed. Crossing these pure whites with pinks we restore a desired color.

My own experiments are unique, in that I had no known or available pinks to work with and that neither *Lord Kitchner* nor *Beacon*

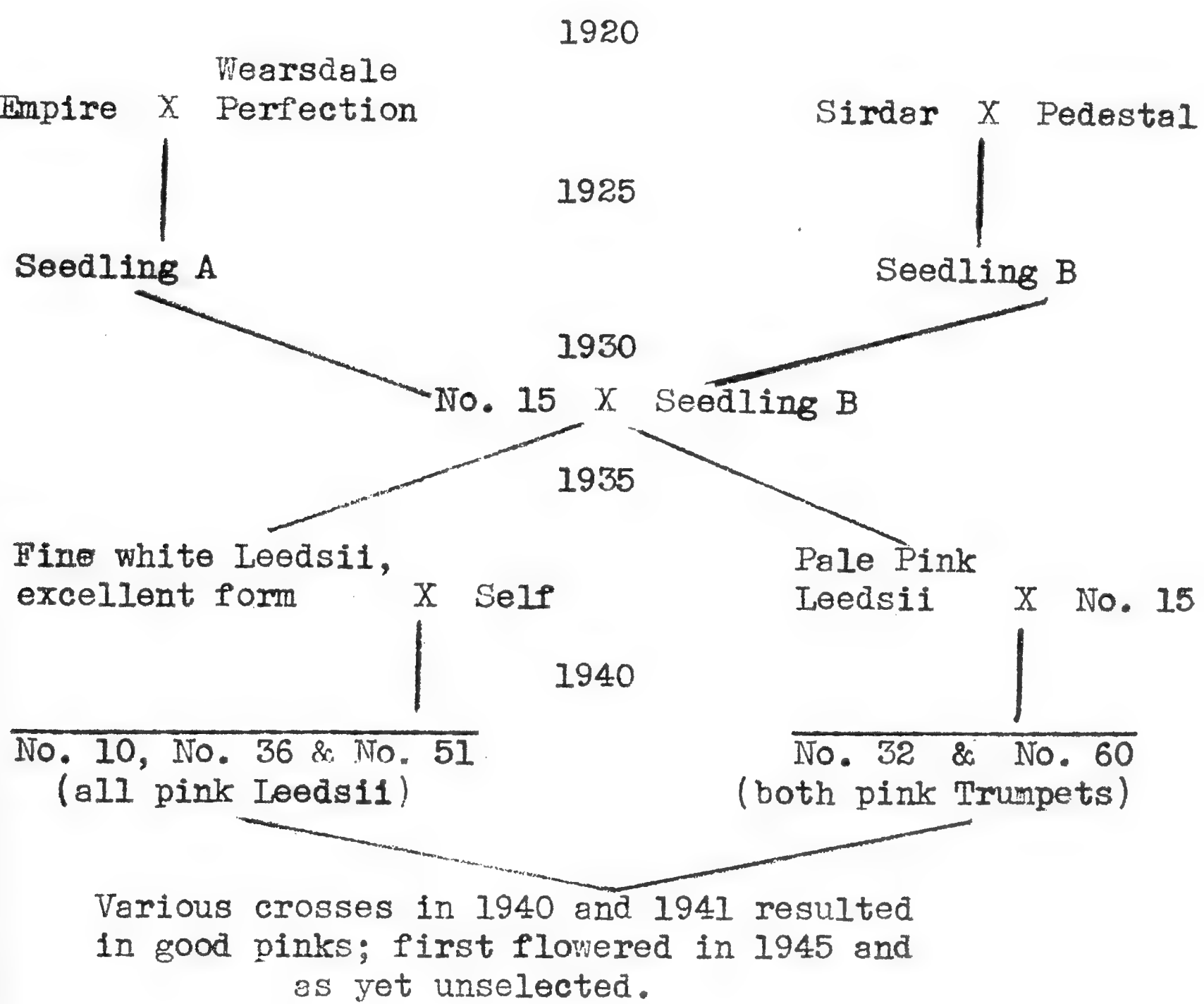


Fig. 146. Crosses resulting in pink *Narcissus*.

was utilized. Starting twenty-five years or so ago with random pollenizing, a seedling from the old Leedsii *Empire* x *Weardale Perfection* showed some illusive flush of pink in an amber-buff or fawn-colored trumpet. Another cross, *Sirdar* x *Pedestal* made with deliberate speculation because of the fact that an English catalog described *Pedestal* as having a red edge or rim—no color ever developed in mine, beyond an almost imaginary flush which definitely was not red—produced another Leedsii inferior but similar to *Fanny Curry*. Now decidedly intrigued, I made reciprocal crosses between these two seedlings, the two

proving fertile both as to pollen and seed parents. The result was a series of Leedsii's; one or two with a very pale pink trumpet; one an amber or coppery pink, similar to *Mrs. R. O. Backhouse* and another a deeper pink but very short-stemmed and both with atrocious perianths; and three with pink-edged cups similar again to *Fanny Curry* but in my estimation superior as to color, size and form.

Again following my own theory, from this same series a white Leedsii of good form was selected and selfed as was one of the pink edged of the "Curry" types. From this white selfed came a truly lovely flower designated only as P-40-10. The perianth is good, the medium-sized trumpet opens with a clear, deep rose pink coloring and the length of stem, habit and form leave little to be desired. This seedling, which flowered for the first time in 1940, was used extensively by me in further hybridization (Fig. 146). In 1941 I crossed it with *Hera*, *Mitylene*, *White Sentinel*, *Sublime*, *Mystic* and several other varieties. In 1942 I crossed it with *Carnlough*, *Evening*, *Eskimo*, *Pinkeen*, *Silver Plane*, *Slemish* and with several of my own unnamed hybrids and again in 1943 and 1944 I obtained some nice quantities of seed from various parents. The future will tell whether my preliminary conclusions will be substantiated by the results from these crosses.

NEW DAFFODILS

FRANK REINELT, *California*

It is very seldom that daffodils freshly imported from abroad show up well the first season after having been hot-water treated on the way, but some seem to be an exception to the rule. *Polindra* which I have been importing for several years is perhaps the best example as it gives beautiful flowers the first season. This year (1944) several new varieties did so well that I am passing judgement on their maiden blooms without fear that I shall have to eat my words later.

Among the yellow trumpets *Kingscourt*, raised by Mr. J. L. Richardson, sets a new high water-mark, and is easily the finest of its class that I have so far seen. Bred from *Royalist* x *Crocus*, it has inherited the best qualities of both. *Royalist*, even today, is one of the best show flowers of beautiful quality. *Crocus*, again, is one of the largest flowers of deepest gold with very wide perianth. Both are comparatively short stemmed under our conditions. *Kingscourt* is a shade taller than its parents and very vigorous with a strong stem and short neck. The flower is not as large as *Crocus* nor as deep a gold, but it is the largest and deepest flower of a really first class quality. The yellow trumpets lack, on an average, a sufficient breadth of perianth along with substance. *Kingscourt* fills the need, especially for breeding purposes.

Mr. Richardson's yellow flowers with red cups seem to be dominating the field of novelties. *Hong Kong*, bred from *Fortune* x *Penquite*, is a very promising advance. Its tall short-necked large yellow flower with an orange-red cup interests me greatly and is perhaps the best yellow and red seedling bred from *Fortune* so far.

Narvik combines the heavy substance of *Carbineer* with the highly colored cup of *Porthilly*. Tall, short-necked, its flowers are not very large, but of beautiful form and first-class quality, making it perhaps the best yellow-red flower yet introduced. I think it will have excellent possibilities as a show, garden, and cut flower, much superceding *Porthilly*, which lacks sufficient substance.

Another promising variety in this class is *Royal Mail*, with a strong color contrast of the frilled red cup against a light yellow perianth. This is quite a large flower, very smooth, of beautiful form, carried on tall stems.

Among the white flowers with red cups, those having snow-white perianths combined with good form and quality, are very few. *Limerick*, which I have grown now for three years, is excellent. Bred from *Folly* x *Hades*, it has an even deeper cherry-red cup than *Hades* itself. It also holds its color well. Even after the petals have dried up, the cup still remains red. *Lady Kesteven* is another snow-white flower of rather variable form. Unfortunately the red color in the cup burns very quickly in the sun. *Matapan*, bred from *Coronach* x *Forfar*, is a medium sized flower on a tall stem flowering earlier than the others of its class and is a welcome addition for breeding.

Two other flowers not new, but still scarce, which I value highly for breeding, are the Poet *Sea Green*, and the short-crowned Leedsii *Dreamlight*. Both have fine snow-white perianths of round form, very flat, carried on fairly tall stems with good necks. *Dreamlight* with a rim of salmon-orange and greenish center of the cup, is one of the most delightful things and perhaps the most perfect of the series introduced by Mr. Guy Wilson. *Sea Green*, which opens last, is tall and of perfect form and also has the greenest center of all.

My impression of *Green Island* as a new advance for breeding mounted, when it bloomed, as it kept expanding. Bred from *Gracious* x *Seraglio*, it is one of those milestone flowers opening entirely new possibilities for the development of large Barrii, "Incomps" and Leedsii. It is a very large flower with a perfectly symmetrical perianth of such a breadth that it almost forms a circle. The very large corona is flat, a porcelain white with chrome yellow edge, and has a greenish center. It has a good long stem and short neck and seems quite vigorous. As a flower, itself, it is perhaps too large and too stiff to be graceful, excepting for show purposes, but for breeding, it certainly is the answer to the breeder's prayer. Good perianths are hard to get. When one comes with such width, substance, and quality as *Green Island* has, it gives the breeder something with which to work.

Guy Wilson mentions in one of his letters having flowered seedlings from *White Sentinel* x *Green Island* with unusual salmon colored cups. Since *Gracious* is known to give pink in its seedlings, I believe we can get beautiful new shades of color from *Green Island*, especially by mating it to short-crowned Leedsii, Poets, and Barrii, besides bringing larger size with better substance in those classes.

The Leedsii with pink or coppery-pink cups are the most recent developments, and the Australian breeders are leading the parade.

Dawnglow is a very large flower of trumpet proportions, bred from *Rosary* x *Pink-O-Dawn*. It is comparatively short stemmed, of nice form with a good cream-white perianth and a deep coppery-pink trumpet. This is the largest of the pinks I have seen and quite promising for breeding.

Among the white flowers, there are several promising novelties. *Broughshane* has not bloomed for me yet. *Cameronian* after two years of sulking, produced magnificent blooms this year. It is quite white both in perianth and trumpet, very large and of beautiful form and has sufficient stem.

The majority of the earlier White Trumpets have too short stems under California conditions, so *White House* is a welcome addition. Bred from *Nissa* x *Tenedos*, it inherited earliness and a tall stem besides being a large fine flower of good form. It does not seem to be appreciated in England, but is very much recommended in Australia and California, both climates being warm which seem to suit it well.

Zero is the whitest Leedsii of the large type I have bloomed so far and undoubtedly will have a great influence on further development of whiter flowers. It is one of the earliest to bloom, is very large and of good form. It lacks only a taller stem and more refinement to be perfect.

THE GREATEST GARDEN THRILL: SUGGESTIONS TO THE AMATEUR BREEDER

J. MARION SHULL, *Maryland*

There is no greater garden thrill than comes with the first sight of a new bloom for which you have assumed complete responsibility as to its origin, have predetermined its ancestral background, particularly if the newborn is genuinely fair and full of promise. And there is no reason why you, the Average Gardener, should not enjoy this thrill. You do not have to be a geneticist, nor the possessor of a University degree to attest that you know all the rules that apply and all the many exceptions to the rules as applied to the multitude of species that inhabit the earth, to carry on respectably and enjoy this keenest of all garden satisfactions. Of course, the more you know of the underlying principles the keener will be your pleasure; but there is no hocus-pocus, no deep dark mystery or secrets reserved exclusively for the 33rd Degree initiates, involved in the primary problems of plant breeding.

The Amateur may well ask for a definition of plant breeding. Is it merely the growing of plants from seed? By no means. True, many a highly prized variety that graces our gardens today has been derived in just that way—its parents, its grandparents, completely unknown. Its survival is due to selection and preservation because of its desirable qualities—but this is not breeding in any proper sense of the word. To merit the name of breeding there must be the conscious bringing together of specific parents, preferably of known ancestral strains, an act usually based upon the idea of uniting in the resulting offspring desirable qualities from both parents.

The basic mechanism that makes such a combination possible is of course the pollen grain or male element and the egg-cell or ovule, the female counterpart. Since these primordial cells carry only half the necessary makings for a complete individual it should be obvious that a single male cell (pollen grain) must unite with one female cell (ovule) to jointly provide the growth material and potentialities required to develop into a seed. The seed in turn will germinate and grow ultimately into a new plant, but it is essential to understanding to bear in mind that throughout its existence it has half of its being derived from one parent and half from the other with all the hereditary possibilities that implies.

In Nature, bees or other insects do most of the carrying and depositing of pollen from anthers to stigmas and as the insect visits many flowers the load of pollen becomes very much mixed, may represent the product of dozens of different males, but only one pollen grain is ever involved in the fertilization of any egg cell so that quite possibly no two seeds in a full pod are derived from the same father. All plants arising from this pod may be only half-sisters at best, the male parent being totally unknown.

But by choosing your source of pollen and placing it upon visibly clean stigmas of the chosen seed-bearing plant you have performed the first act of deliberate plant breeding. The resulting seed is a combination for which you are entirely responsible. You have intervened, have joined with the forces of nature in setting up a reaction that may eventuate in a wonderful new "creation" for which you are entitled to claim at least some credit. Or on the other hand it may turn out a monstrosity for which you must accept part of the blame. It is always something of a gamble with sometimes joy and sometimes disappointment as the payoff. But in any case you still possess the power to destroy or to preserve as you see fit.

The idea that there is something occult and mysterious in the production of new varieties, some great and rare gift of knowledge and foresight that the plant breeder must be possessed of, has sometimes been fostered by practitioners of the art. The way to fine progeny is to use nothing but outstanding quality in the ancestral lines. It is true that a poor cow may have a good calf, or a good cow have a poor one, but the cattle breeder who depended on these probabilities as his main stand-by would quickly go broke.

Whether you wish to breed new *Hemerocallis*, *Iris*, or any other flower that appeals to you, choose good ancestry not only for the immediate generation but for as many generations back as may be possible, and unless you have unlimited time, space and human energy, keep clear of the shot-gun method with the bees as your chief assistants. Select your breeding stock with the utmost consideration, and if you desire a wide variation in the offspring, select for parents individuals with very divergent characters in color, form, etc. but always of the best in their class.

One final word. Remember that every fond parent tends to be but a poor judge of his own flock. Allow several years of observation for even the most promising child before launching it officially into the horticultural world. It may be a winner, but in any case you will have had your thrill of seeing a new life come into existence.

DAYLILY BREEDING AS A HOBBY

MR. AND MRS. EUGENE A. TAYLOR, *Massachusetts*

In the fall of 1927, my wife and I decided to purchase a permanent home in the country, where we could live the year around, instead of moving to the country each spring and back to the city again in the fall as we had been doing. We found a little, old farmhouse with a barn and four acres of land in a small, eastern Massachusetts town. The house, over one hundred years old and shaded by large elm, ash and maple trees, was within ten minutes walk of the stores and the post office. *Hemerocallis fulva* and *flava* grew all over the place by the thousands. It was not until nearly ten years later, however, that we read an interesting article about daylilies in a garden magazine. This gave us the idea to begin hybridizing.

Most of our early crossings produced only yellow and orange lilies, but a crossing of *Mikado* with one of our own deep orange seedlings gave us, at least, two seedlings in a good red self, almost exactly alike, except in size. This was really the beginning of our career as amateur hybridizers. We then collected a number of new outstanding varieties from some leading producers. In July of 1942, we transplanted from our seed bed to permanent positions, about 3500 seedlings. We have raised about the same number each year since then. Now we have many colored seedlings on trial that hold great promise for the near future.

Our experience, here, in this locality has been that seeds planted in October and transplanted to permanent beds the following July, will, if lightly mulched after the ground freezes, give a good percentage of bloom the following summer.

We have had some trouble with thrips, but we have been able to control them quite well with rotenone dust, applied after the dew has fallen.

From the beginning, we decided to breed for strong, well-branched plants, as we believe that these are one of the most important features in successful daylily breeding.

THE CHARACTER AND GENETICS OF DOUBLENES IN THE FLOWERS OF DAYLILIES: THE PARA-DOUBLE CLASS

A. B. STOUT,
New York Botanical Garden

*Features of Doubleness: Types of Flowers;
Classes of Individuals and Clones.*

The fundamental features in the doubleness of flowers of daylilies are (a) petalody of stamens, (b) reduplication or multiplication in the number of whorls of petals and petaloid stamens, (c) abortion of stamens and (d) either complete abortion of pistils or their reduction and sterilization.

Types of flowers. In respect to the extent to which one or more of these features may be developed, the individual flowers of daylilies may be recognized and designated as follows:—

1. *Super-double.* Having no functional stamens or pistils; usually with completely sterile petaloid stamens and duplication of petals or of petaloid stamens. Such a flower is fully sterile.
2. *Para-double.* Having at least some well-formed stamens or petaloids with some traces of anthers. Usually there is duplication of petals or petaloid stamens. There is abortion or sterilization of the pistil. Such a flower is sterile as a seed parent.
3. *Semi-double.* Having only petalody of some stamens or occasionally of all stamens. Usually the pistil is normal. Nearly all flowers of this class are potentially fertile in respect to some stamens and the pistil.
4. *Pseudo-double.* Occasionally some flowers of daylilies have more than the normal number of parts within each whorl in the flower. When such a flower has four petals there are usually also four sepals, four stamens in each of the two whorls and four carpels in the pistil. There is further increase in the number of parts until it is obvious that there is fusion and fasciation involving two somewhat distinct flowers. In such flowers there are apparently sporadic and incidental irregularities in development and growth that are of doubtful or incomplete genetic value.

Classes of individuals or clones. No entire plant or group of ramets of a clone of the daylilies now known is to be classed as super-double, for in no case are *all* of the flowers super-double. The para-double class at the present time consists of only two cultivated clones. These have few super-double flowers, numerous para-double but no semi-double flowers (to the author's present knowledge), and no normal single flowers. The semi-double class is known to the writer only in seedlings which have been grown at The New York Botanical Garden. The first of these appears to be spontaneous mutations.

It should be noted that in no case is petalody of stamens complete in all the stamens of all the flowers produced by either of the two clones of

para-double daylilies, or by any one of the seedlings thus far obtained of the semi-double class.

This present paper will deal only with the para-double class of daylilies. It is the plan to report later on the semi-double class.



Figure 147. Flower of the **Flore Pleno** Daylily. There are 13 petals and two petaloids which have traces of anthers (at a-1 and a-2). One petaloid is a half-stamen (a-1). The 15 petals and petaloids together with the three sepals are in six whorls of three each and they are in six ranks of three each. Thus each sepal has two petals directly above it and each of the primary petals has two petals or petaloids above it. There are five well-formed stamens of different lengths, but no trace of a pistil and no rudimentary, aborted, and sterile stamens.

The Two Para-double Clones in Cultivation

History and Identity. In 1860 and 1864 two fulvous daylilies which are to be classed as para-double were described of living plants that had been introduced into cultivation in England. In the early descriptions (see discussion by Stout 6, 8) these two clones of horticultural daylilies were assigned to different species but it is now evident that both are closely related to the *Europa* Daylily which is the Linnaean type of the species *Hemerocallis fulva* and that the most satisfactory names for them are *Hemerocallis fulva* clone *Flore Pleno* and *H. fulva* clone *Variegated Kwanso*.

In the foliage of plants of the *Variegated Kwanso* there is a chimeral association of green cells and white cells and in the formation of vegetative buds there are frequent segregations of green cells which form branches that continue as a *Green Kwanso*. But the flowers of the *Variegated Kwanso* and the derived *Green Kwanso* are alike in character and hence the flowers of the two clones may collectively be discussed under the name *Kwanso*.

There has been confusion, especially in horticultural literature of daylilies, in the application of the names *Flore Pleno* and *Kwanso*. The flowers of both are to be classed as para-double, but there are distinctive though rather minor differences readily to be recognized in the degree to which the features of doubleness are developed (see figures 1 and 2) and in the range of the variations in the flowers of each clone. Also the new leaves of ramets of *Flore Pleno* appear somewhat earlier in spring than do the leaves of *Kwanso* and they are more bluish green in color. Both clones are triploid ($3n=33$) as is the *Europa Daylily*(7). Of the entire genus *Hemerocallis*, including wild species, horticultural clones, and seedlings known at the present time, the clones *Flore Pleno* and *Kwanso* (*Green* and *Variegated*) are the only ones that have predominately para-double flowers, few super-double flowers and no normal flowers.

Petalody of stamens is recognized as the most fundamental and characteristic feature in many cases of doubleness in flowers. In the para-double daylilies there are various degrees in the expression of petalody. The colorful, bladed, petaloid structures are usually placed between a whorl of petals which is in the position of the petals of a normal flower (see Figures 147 and 148) and the stamens that may be present but frequently the two are somewhat intermingled. As a rule, at least some of the petaloid stamens are bladed structures that bear some traces of anthers or pollen sacs. The transition from rather normal stamens to fully sterile, colorful, normal petals is somewhat continuous but may be discontinuous.

In referring to these *petaloid stamens* of daylilies the term *petaloid* may be applied as a substantive with the understanding that here the petaloids are all modified stamens and not carpels. The term staminode is scarcely applicable to them for it refers to a sterile and aborted stamen of the type often seen as a rather constant feature in flowers that exhibit no petalody.

In daylilies the petalody of stamens involves variations in the number of petal-blades, petal-wings, or lamellae that are of special interest and significance.

(a) There are what may be called half-petals or uni-lamellate petals one side of which is a well-formed petal-wing while the other side is a half-stamen (see 4 in figure 149).

(b) There are grades of petalody that appear quite like normal petals except that there may be portions of anther sacs near the apex and often on or near the midrib (see 2 in figure 149). It may be considered that in these there is a lamella or wing on each side of the midrib. As in normal petals there is a very uniform dorsiventral differentiation

in the coloration. In respect to further developments in petaloids these two wings may be called primary wings.

(c) A tri-lamellate petaloid is produced when there is another wing in addition to two primary ones.

(d) The development of two secondary and two primary wings forms a four-bladed petaloid (see 3 in Figure 149).

These secondary lamellae unite with the primary ones along a common midrib. Each secondary lamella has *only one side* that is strongly colored like the face of a normal petal and its other side is like the back of a petal. When there are two secondary wings the colored side of each meets, and is continuous with, the strongly colored face of the primary lamella that is adjacent. The secondary lamellae are usually much less in width than are the primary lamellae.

The bilateral symmetry and the relations and developments of the parts of a quadri-lamellate petaloid very definitely suggest that the structural elements correspond to those of the sterile tissues of the outer walls of an anther. The strongly colored surfaces of the petaloid correspond to the zone where sporogenous tissue meets the sterile tissue in an anther.

In many of these petaloids the three or the four lamellae extend from the very base to, or almost to, the apex and there is no evidence of a basal section that can be called a remnant of a stamen filament (see 3 in figure 149). But in a half-petaloid one side of the structure is like a filament of a stamen in appearance and it usually terminates in a portion of an anther (see 4 in figure 149).

Wing-like processes in petaloid stamens have been described by Masters (5) in the flowers of species of *Rhododendron*, *Azalea*, *Crocus* and *Viola*. Masters recognized that the relations and developments of the four-winged petaloid very definitely suggest that the structural elements correspond to those of the sterile tissues of an anther and that "the two wings on each side of the central vascular cord represent the front and back walls of another lobe" (5, p. 289). Masters illustrates (5, fig. 155) petaloids of *Rhododendron* in which the four wings are at the base above which there is a rather normal filament and two pollen-sacs or "quarter-anthers." It seems that little attention has been given to the presence of wing-petaloids in most recent studies of doubleness. But evidently there are other types which involve "proliferations" of petals and stamens.

Reduplication or multiplication of petals, of petaloids or of stamens, or of all three is a feature characteristic of the para-double flowers of daylilies. This is especially evident when there are more than six stamens (figure 148), or more than six stamens and petaloids, and when the total of petals, petaloids, and stamens is more than nine. In the flowers of both para-doubles and semi-doubles the first whorl of three sepals and the next whorl of three petals are, as a rule, normal in number and character. The reduplications occur above the whorl of primary petals and are on a somewhat extended central axis (see figures 147 and 148) formed in the region below the position of the ovary.

Abortions of stamens and petaloids. There are often some stamens that are fully normal in the size and the appearance of both filament and anther. But in flowers of the para-double class there are also gradations to structures that are of small size and that are composed of sterile tissue only. Some of these retain the form of stamens. Others are somewhat bladed. These occur especially toward the apex of the central axis and are often above the fully formed stamens that may be present.

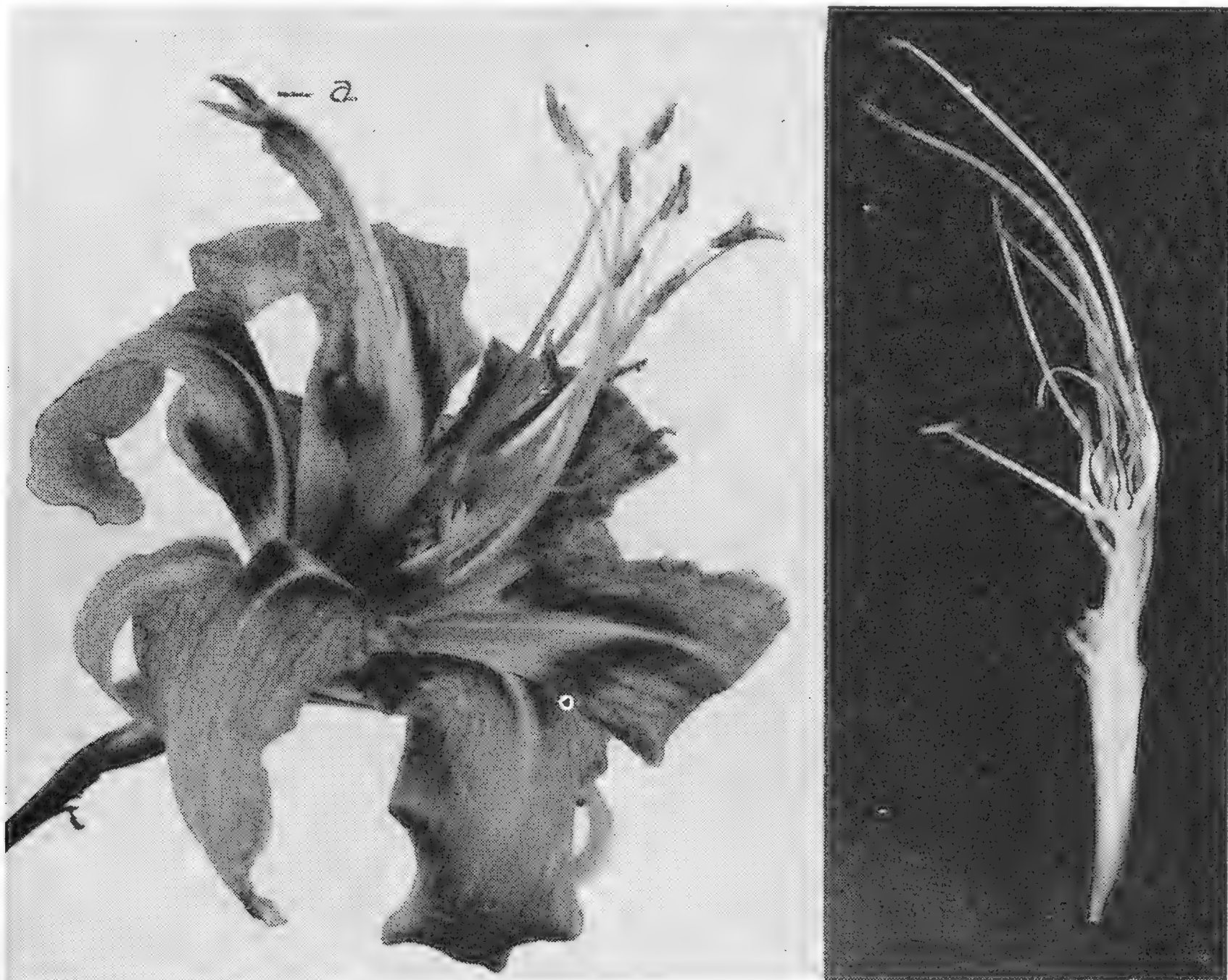


Figure 143. At left: flower of the **Kwanso** Daylily. There are nine well-formed petals, one half-petaloid (a), 13 stamens and a much-reduced pistil not visible in the photo.

At the right: the central column of a flower with sepals and petals removed. There are thirteen stamens of various lengths; the pistil is reduced to a single carpel with slender twisted style and a small ovary.

Individual super-double flowers, that are fully sterile and which have no stamens and no traces of anther sacs on the petaloids are occasionally present among the numerous flowers of the *Flore Pleno* clone. But at the present time no individual plant of *Hemerocallis* can be classed as super-double. This condition of complete sterility, called "petalomany" by De Vries (2), is characteristic of the flowers of individual plants of certain other genera.

Abortion and malformation of the pistil. In no flower of either the *Flore Pleno* clone or of the *Kwanso* clone has a normal pistil been observed. In the extreme abortions, characteristic in flowers of *Flore*

Pleno, there is to the eye no trace of a pistil and often the last structure visible is definitely a rudimentary stamen. Yet it may be that in some flowers, especially of *Kwanso*, there is some petalody of the carpels of a pistil and even also reduplications of them which, however, are of relatively small size.

In some flowers of the *Kwanso Daylily* the pistil may be present but it is much reduced in size and often it is more or less separated into slender styles (see figure 148). One or more of the carpels may be fully separated to the base of the ovary in which case the basal portion is greatly reduced in size in comparison with a normal ovary.

No seeds have been produced in any of the many flowers that have been observed on ramets of *Flore Pleno* and *Kwanso*, and no seeds or even enlargements of the base of the pistil have been obtained when hand pollinations have been made.

A comparison of the flowers of the two clones, Flora Pleno and Kwanso. The flowers of the *Flore Pleno Daylily* (see figure 147) in comparison with those of *Kwanso* (figure 148) have a greater number of well-formed petals, the number of stamens and aborted stamens per flower is less, and the pistil is more frequently fully aborted or not in evidence. The central column of the flower is shorter and the flower is more compact. The number of fully formed petals in flowers of *Flore Pleno* usually ranges from 8 to 14 and the number of well-formed stamens usually ranges from 6 to 0.

The flowers of the *Kwanso* type (figure 148) show wide variation in the relative numbers of petals and stamens. Frequently the only well-formed petals are those of the primary or first whorl in which case the number of poorly developed petaloids and normal and abortive stamens is high. Decrease in the number of bladed petaloids is accompanied by increase in the number of stamens (see figure 148). Often in the flowers of *Kwanso* the petals and petaloids are much twisted and curled.

Data on the Genetics of Para-doubleness

Breeding results. Some of the pollen produced by the triploid female-sterile clones *Flore Pleno* and *Kranso* is viable which is also true of the triploid *Europa* Clone (1). Beginning in 1925 and continuing to date * numerous cross-pollinations have been made using the pollen of these clones on pistils of single-flowered plants (a) of several species, (b) of other members of the *H. fulva* group including triploids, (c) of seedlings of the semi-double class and (d) of selection hybrids that would contribute new coloring to any para-doubles that might appear. Many of these cross-combinations did not yield seeds; many of the seedlings obtained were weak and either died or did not flower.

In a first generation of *Flore Pleno* as a pollen parent there were 14 different progenies of which 120 plants flowered. Of the *Kwanso* parentage there were 11 progenies of which 71 flowered. Every one of

* During July of 1936 and 1937 some of these pollinations were made by Professor John V. Watkins under scholarship grants.

these seedlings had flowers in which there was no trace of any of the features of para- or semi-doubleness.

Pollinations were made which involved single-flowered triploids as the female parent ($3n$ single \times $3n$ para-double). Most of these did not yield seeds, but 21 seeds were obtained from which five seedlings were flowered. All of these were single-flowered; two were triploids of very weak constitution. There were no tetraploids.

A report has been made (Stout, 7) regarding the chromosome complement in various of the seedlings which have *Flore Pleno*, *Kwanso* and the *Europa* clones in their parentage. These studies indicate that the majority of such seedlings are diploid ($2n-22$), some are aneuploid, some have mixiploidy and a few are triploids. The chromosome numbers of various plants that were weak and which soon died were not determined.

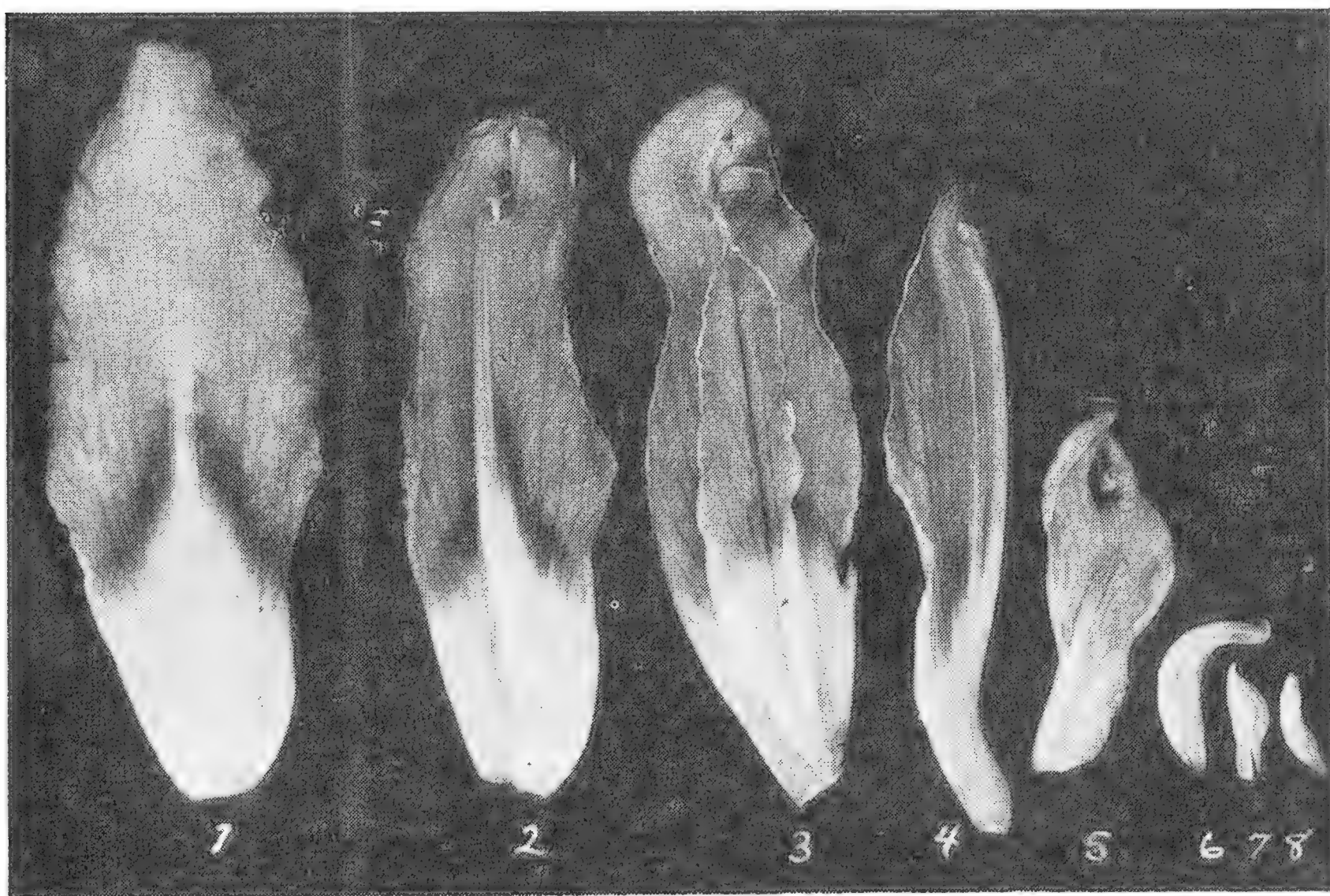


Figure 149. Several gradations of petals and petaloids from flowers of the **Kwanso** Daylily. From left to right; a primary petal, a two-bladed petaloid, a four-bladed petaloid, a one-bladed or half-petaloid, a petaloid of reduced size but with two blades, and 3 much reduced and almost colorless petaloids which show no trace of anther sacs.

For F_2 and later generations. Certain first generation plants noted above were used (a) in self-pollinations, (b) in intra- and cross-pollinations and also (c) in back cross-pollinations with *Flore Pleno* and *Kwanso*. Some lines of this breeding have been continued into a fourth generation.

Of the progenies of parentage derived exclusively from first generation seedlings of either *Flore Pleno* or *Kwanso* parentage there were 53 series of seedlings and a total of 465 plants. Of these seedlings only *one* has had any feature of doubleness and of its flowers only a few have had either one or two (and no more) petaloid stamens. But there was no reduplication of either petals or stamens and the pistils were normal and hence these flowers were definitely of the semi-double class rather than of the para-double class.

Some of the best of the first generation and also of later generations of the single-flowered seedlings of these generations were used in certain lines of selective breeding in which the other parents had no para-doubleness. In none of the offspring has there been any features of doubleness.

The matter of somatic segregation. No somatic segregation for different degrees of doubleness has been observed in the propagation of any ramet of either the *Flore Pleno* or the *Kwanso* clones. There is considerable fluctuating variation among the para-double flowers of the *Kwanso* type in respect to the number of well-formed petals and stamens. There is less variation among flowers of *Flore Pleno*. But in no flower of these two clones has the variation given a perfect flower with three sepals, three petals, six stamens and a normal pistil. But in no instance in any ramet of the para-doubles has there been bud sporting or somatic segregation that results in branches which continue as sub-clones whose flowers are noticeably different in the type of doubleness or in the range of variation of any aspect or degree of doubleness.

Reports have been received by the writer, in letters and verbal reports, from persons who stated that they had observed double flowered fulvous daylilies among daylilies where there had previously been only single-flowered plants. All such plants of which the writer has seen flowers proved to be either *Flore Pleno* or *Kwanso*, and in all cases that could be traced to immediate sources the plants were propagations of these clones.

In a few cases persons have stated that they believed that double-flowered daylilies had arisen as seedlings, but in only one case was further information given. This correspondent stated that (a) seed of daylilies were obtained from a nursery, (b) that four seedlings were grown for a time in a window box and then planted in the garden of a relative, and (c) that a few years later all four produced double flowers. A division of each was obtained and grown at The New York Botanical Garden. The flowers produced by all four of these ramets are identical to those of the *Kwanso clone* in color and character of doubleness, and these plants are also like those of the *Kwanso clone* in time of flowering and habits of growth.

The writer has been expecting that some reports or inquiries would be received which refer to seedlings of the semi-double class like those that have appeared among seedlings grown at The New York Botanical Garden. No doubt such seedlings have also appeared elsewhere. Thus far the reports of "new doubles" that have come to the writer have been

concerned only with para-doubles and the evidence is that these are merely one or the other of the old clones *Flore Pleno* and *Kwanso*.

Further Breeding for Doubleness in Daylilies

Certain lines of further breeding for para-doubleness in daylilies may be suggested for those who may wish to attempt such breeding.

(1) A large number of both F_1 and F_2 progenies of the single x para-double combination would increase the chances for the segregation and recombination of all the genes that may be necessary for the expression of doubleness, or of one or more of its features.

(2) Special attention can be given to the breeding of triploids of the F_1 in which there are, presumably, two genomes from the para-double parent. In the inter-breeding of these triploids there is possibility of increasing the proportion of chromosomes of para-double origin in both $2n$ and $3n$ seedlings and perhaps also in any $4n$ seedlings that may arise.

Thus far the writer has grown to flowering age only four seedlings which had both parents triploid. All were single-flowered; three were diploid; one was triploid and of very weak growth.

It may be possible to continue the three genomes of chromosomes present in *Flore Pleno* and *Kwanso* with their complete determination of doubleness provided functional spores are sometimes formed without reduction. Counts of the distribution of all chromosomes in all four microspores formed from each of 15 pollen-mother-cells of the triploid *Europa* gave numbers ranging from 10 to 21 (Chandler, 1, Table 5). The highest number of chromosomes in seedlings which has one parent or both parents triploid was 33 or $3n$ (Stout, 7).

There is at present no evidence that viable $3n$ pollen grains are formed by triploid daylilies or are functional if occasionally produced. In the triploid bananas it is reported (Dodds, 3) that functional $3n$ gametes are formed only in ovules and not in pollen. Should such a special condition operate in the para-doubles of daylilies $3n$ pollen grains would not be formed.

Discussion and Conclusion

The para-double type of doubleness occurs infrequently in *Hemerocallis*, for it is known in only two clones of this genus, the *Flore Pleno* and the *Kwanso Daylilies*. Both are triploid ($3n=33$) and both are closely related to the triploid single-flowered clone *Europa*. The clones *Flore Pleno* and *Kwanso* differ somewhat in the degrees to which the main features of (a) petalody, (b) multiplication of parts, and (c) abortion of stamens and pistils are expressed in their flowers. Hence it must be assumed that there are some differences in the genetic constitution of these two clones. Either of these clones may have arisen from the other by somatic mutation; there may have been the independent origin of each; the present condition of para-doubleness may have involved more than one mutation and an accumulation of modifying factors necessary for the different features of para-doubleness.

*The para-double character exhibits considerable somatic variation, but the ranges of variation are remarkably constant over a period of years in the ramets of each clone, for in no flower has a functional pistil been observed, and a normal single-flower has not been found. There is no evidence of somatic segregation for the variations in the degrees of doubleness in either of these clones. The genetic constitution of each clone has continued, as has that of the single-flowered *Europa* clone, throughout long-continued and numerous propagations and wide geographic distribution without any definitely known further effective somatic mutations and segregation.*

Hereditary values of para-doubleness in Hemerocallis. The rather large number of seedlings of the F_1 obtained of *single* x *para-double* all had single flowers only. Also in the F_2 progenies that were grown there were no para-double flowers. If any feature of the doubleness is determined in these plants by a single genetic factor such a factor must be recessive. If this is the case then the *Flore Pleno* and the *Kwanso* clones should be homozygous for this factor. But the results thus far obtained in F_2 and later generations indicate that there were no recombinations which were effective in the transmission and expression of any one feature of para-doubleness. This suggests that there is either (a) polygenic and heteroallelic determination with complexity of modifying interactions, or (b) the elimination in sporogenesis or in embryo abortion of one or more factors essential for the transmission of doubleness.

There were two seedlings in the F_1 progeny of the para-doubles which were triploids. Presumably each of these had two genomes from the triploid para-double parent. Both seedlings had only single-flowers, hence it would seem that two of the three genomes in the para-double plants are not always sufficient to provide transmission and expression of any feature of the doubleness, at least when there is also present a genome of a single-flowered plant.

The genetical status of petalody in daylilies. It may here be stated that in the semi-double type of flower petalody of stamens exists independently of any other feature of para-doubleness, but these cases of petalody evidently first arose as independent mutations and not as segregates in the progeny of para-doubles.

No attempt is here made to present or discuss the evidence bearing on the role of petalody in the evolution of flowers or on the available data on the genetics of doubleness in genera other than *Hemerocallis*. There are some relatively simple cases of heredity both for dominance and for recessiveness of the doubleness. But there are other cases of greater complexity, of incomplete and indefinite segregation, and also some cases of highly specialized heredity.

The results reported in this paper seem to indicate that it will not be an easy and simple procedure to obtain seedlings of *Hemerocallis* that bear para-double flowers either among the progeny or para-doubles or as new mutations.

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4. PHYSIOLOGY OF REPRODUCTION

HOT WATER TREATMENT FOR REJUVENATION
OF AMARYLLIS BULBS

IDA LUYTEN

In my researches on vegetative propagation, I often had small hybrid *Amaryllis* (syn. *Hippeastrum*) bulbs (circumference less than 10 cm., and 10-16 cm.) which stayed behind the others. They did not increase in size although for the rest they seemed quite healthy. Mr. Th. M. Hoog, member of the firm C. G. van Tubergen, Jr., at Haarlem, advised me in 1927 to try a hot water treatment. As these bulbs were kept growing on in consequence of their small size, Mr. Hoog advised me to give them a bath at the end of December or the beginning of January. He also told me to cut off the roots after the treatment before repotting. This manipulation should further speedy rooting, while the presence of the old roots would give chances for rotting.

We chose $43\frac{1}{2}^{\circ}\text{C}$. for the hot water treatment, the same temperature that was used for combating eelworms in hyacinths and daffodils (van Slogteren 1920) :—

Bulbs with circum. less than 10 cm. were treated $2\frac{1}{2}$ hours.

Bulbs with circum. from 10.1 to 16 cm. were treated 3 hours.

Bulbs with circum. more than 16 cm. were treated $3\frac{1}{2}$ hours.

To keep the water constantly on $43\frac{1}{2}^{\circ}\text{C}$., we used our automatic mercury-regulator (for description see Versluys 1927 page 14) which was placed (hung) in the water of a zinc tank with its whole u-shaped part

as far as the screw. By means of this screw the regulator can be accurately adjusted to $43\frac{1}{2}^{\circ}\text{C}$; the regulator switches off and on the current for two round-shaped electric-stove elements, placed under the tank. The bulbs are brought into the water in small labelled sacks, using a basin tray with a bottom of gauze. This tray protects the sacks from sinking to the bottom of the tank which is heated directly and therefore has a much higher temperature. The gauze makes possible good circulation of water.

After this treatment the bulbs soon formed roots and leaves. After 1928 the hot water treatment was put into practice every year. We also treated larger bulbs measuring 16-18 cm. Encouraged by the favorable results we later also treated bulbs destined for forcing (circum. 18-20 cm.) or bulbs which were clearly decreasing in size. Depending on the time we started the storage treatments, the hot water treatments were given in the 2nd and 3rd week of September—in later years always in the first week.

The leaves were cut off but, it was not necessary to remove the roots of the larger bulbs. After the treatment the bulbs were planted at once, and the roots soon formed new laterals.

Some figures showing the effect of the treatments on bulb circumference are given below. It is known, that the hot water treatment has also a good influence on the growth of Hyacinths and Narcissus (van Slogteren 1931). It is interesting to note that *Amaryllis* bulbs with a relatively smaller bulb circumference flower after the hot water treatment:—No. 20, 78 and 25 have 2 flower-stalks (scapes) with a bulb-size of resp. of 17.0, 16.9 and 17.4 cm.

Table 1.

No.	circum. Sept. '35 cm.	number, flower scapes	circum. Sept. '36 cm.	number, flower scapes	circum. Sept. '37 cm.	number, flower scapes	circum. Sept. '38 cm.	number, flower scapes
20	19.4	0	17.0(W)	2	27.1	3		
23	21.7	0	19.0(W)	0	26.4	2	33.1	1
78	15.05	0	16.9(W)	2	22.4			
90			18.6(W)	2	27.5			
92	18.4	0	18.0(W)	0	30.9	2	38.15	2
	17.4	0	18.3(W)	0	22.15	1	28.2	1
125	15.3(W)	0	23.6	1	23.5	0	24.5	2
	17.9(W)	0	27.1	3	28.4	2	27.1	1
	18.7	0	18.0(W)		18.4(W)		27.2	2
25	15.3(W)	0	17.4(W)	2	22.1	1	28.85	1
	17.4(W)	0	16.5(W)		22.1	1	24.8	1

Table 1 shows that without hot water treatment several bulbs kept the same circumference for some years in succession (No. 78, 92, 125, 125) or decreased (No. 20, 23). After the treatment (indicated by W) they increased in thickness, often very rapidly (see for instance nos. 20, 90, 125). These bulbs maintain mostly a good circumference. Sometimes one has to repeat a treatment after several years. Also one hot water treatment may not be sufficient (25 and 125). If one repeats the treatment the following year, the bulbs will surely increase thereafter. Once

in a while it occurs that a bulb dies after the treatment. If this happens, it was always evident by cutting, that the bulb had been diseased. This was the cause of the decaying in growth; the hot water treatment made it worse and the death was the result. We can advise this hot water treatment with the utmost confidence. The cultivation of *Amaryllis* bulbs will be facilitated by it. It will also be possible to rejuvenate rare and expensive bulbs, that are declining, into good large flowering ones again.

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CHROMOSOME NUMBERS IN SOME SPECIES OF THE GENUS *ALLIUM*

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We have investigated nine species of the genus *Allium*. One of them, *A. vineale* L., has $2n=32$ chromosomes. Seven species, *A. atrovioleaceum* Boiss., *A. fuscovioleaceum* Fom., *A. Cepa* L., *A. callidictyon* C. A. M., *A. paniculatum* L., *A. Kunthianum* Vved., and *A. materculae* E. Bordz., have $2n=16$ chromosomes. *A. pseudo-flavum* Vved. has $2n=18$ chromosomes.

(The above summary is extracted from a Soviet journal, *Proc. Acad. Sci., Armenian S. S. R. (Erevan)* II. 141-143. 1945. —W. T. Stearn)

5. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION,
USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

AMARYLLIDS IN SAN ANTONIO, TEXAS

MARGARET FOSTER KANE, *Texas*

The soil and climate in this part of Texas are definitely on the side of the would-be grower of the *Amaryllidaceae*. The soil, although heavy clay in some sections and light leaf-mold in others, needs little additional fertilizer except where the needs of some special plant are indicated. The annual rainfall is 27.05 inches, the average minimum temperature is 57.2°F. and the average maximum temperature is 78.5°. The coldest weather ever recorded was 4°F. above zero in 1899, and the hottest was 107° in 1909. The rainfall is scattered throughout the year with the greatest part coming in the late fall and early spring when it is most needed. Although sudden cold or hot spells occur they rarely do any damage to amaryllids.

Narcissus flourish as they do all over Texas, the large bulbs as shipped by the growers split up it is true, but the flowers continue to come. They are not as large and magnificent in after years as at first but unless the gardener wants size alone they are quite satisfactory. *Lovenest* has been an attractive bloomer for three years and so has *John Evelyn* but the blooms are not large. They last well sometimes as long as eleven days per bloom if the weather is favorable. *Mrs. R. O. Blackhouse* has not proved permanent in some gardens but this may have been due to some fault in culture. The exceptions are made up for by the lovely drifts of *Early Virginia* daffodils and campernelle jonquils both increasing from year to year. Bulbs of all narcissus whether hybrids or species are left in the ground all year as exposure to the hot air would do more harm than good.

The paperwhites and their yellow relatives (Tazettas) sold for growing in water multiply rapidly and are among the first to bloom. The old fashioned double called "butter-and-eggs" is at its best in the moist, early spring weather typical of this section. They closely resemble a pale yellow rose.

Leucojum vernum is a favorite substitute for the difficult lily-of-the-valley, each bulb bears several spikes of flowers and blooms over a long period of time. It has proved its worth in many gardens.

Hybrid *Amaryllis* make a vivid spot of color in many a garden, being perfectly hardy out doors without special care. Seed is set freely and without special attention to pollination by hand. The hybrid *Johnsonii* is seen everywhere, it multiplies rapidly and never fails to bloom. The *Amaryllis* is very popular and will become more so when a wider range of color and variety is available from local distributors.

Not quite so easily grown is *Amaryllis belladonna* (syn. *Hippeastrum equestre*) but in one spot at least it is grown to perfection. Here

the soil is gravelly, drainage is perfect and no fertilizer has been used, other than bonemeal. It sets seed freely and offsets are abundant. In many situations with better soil it is a disappointment for it sulks and refuses to bloom.

Crinums grow and bloom well, the bulbs as a rule send up so much foliage that only the large garden can afford the space. *Cecil Houdyshel* is a favorite, also *Ellen Bosanquet*. Both of these are moderate in the foliage increase and generous with blossoms. The fact that *Ellen Bosanquet* flowers on a shorter stem with more open flowers is a good point with all who see it. The flowers of *C. Kirkii*, *J. C. Harvey*, *C. Powellii*, appear to the average spectator, out of proportion with reference to the amount of stem and foliage, and it is to be doubted that they will ever become popular garden subjects. Many other crinums flourish in San Antonio, at least half a dozen different ones going under the name of "Milk and Wine Lily."

Nerines refuse to flower more than one season and sometimes not even that, the fault being that the foliage is too tender even for this mild climate.

Lycoris however, are one of the finest of the fall-blooming bulbs. *L. radiata* blooms early in September, great clusters of coral beauty, perfectly hardy and permanent. In beds planted with white petunias and shielded from the hot afternoon sun they make a really beautiful picture. They bloom at a time when the gardens are at an "in-between" stage, other flowers have passed their peak bloom and the fall flowers have not yet begun. Fertilized with barnyard manure in liquid form while the leaves are growing they respond with two or three spikes of bloom from each bulb. *L. radiata* should be planted at least three inches deep and care taken not to disturb the bulb while dormant. Bulbs that are moved often refuse to bloom the first season. While offsets are freely produced, seed is unknown, at least not to mature.

L. aurea is not as well known but it will grow and bloom if slight protection is given the foliage either by covering when heavy frosts are expected or by planting it on the sheltered side of a building. The blossoms are larger than *L. radiata* and not borne in such a definite circle. The color is a most attractive yellow and a clump presents a definitely satisfactory picture. *L. squamigera* and *purpurea* bloom but do not give increase, other species are unknown here.

Brunsvigia rosea grows and puts out foliage but never a bloom. The bulbs are permanent but the foliage is winter-killed. The winter of '44-'45 having passed without a freeze killing the foliage may give this a chance to bloom but that is yet to be seen.

Hymenocallis galvestonensis grows and flowers in moist or dry soil, under trees or out in the open. The glossy leaves and spidery white flowers are worthy of consideration for garden culture although a well-grown subject takes as much room as a crinum.

Ismene is not satisfactory unless the bulbs are taken up each year. If left in the ground the bulbs split up and do not flower. The hybrid yellow *Sulphur Queen* may be more satisfactory but it has yet to be tried out.

Amaryllis advena known as the Ox-blood Lily flourishes and multiplies rapidly. Blooming in late August the flowers eke out a flower border where the sun has proven too much for all except the zinnias and marigolds. The bulbs should be planted in groups of not less than six, the flowers are small but colorful, especially when planted where the sun can shine through the blossoms. No amount of watering harms the dormant bulb and it may well be planted in the foreground of the mixed border for a splash of color in the late summer. The variety of *A. advena* that has pink flowers is just as hardy and satisfactory but needs planting in semi-shade to protect the delicate color. The leaves of either are a nuisance when gardening in the late spring so when nearing maturity they may be braided and tucked out of sight or folded over into a clump and tied with the leaves of nearby *Hemerocallis*, these leaves are tough and inconspicuous. The red does not set seed here but the pink will do so.

Zephyranthes are becoming better known garden subjects especially among Garden Club members. *Z. grandiflora* is in bloom after every rain beginning in May and continuing until December often blossoming on Christmas Day. The flowers open a deep rosy pink and fade gracefully over a period of several days. Blooms are large and borne freely, one bulb will sometimes bloom three times in succession and then rest to bloom again the following month. It is worthy of note that no matter how long the drouth no amount of hydrant water will force them to bloom. An effort has been made to have them bloom at will by withholding moisture and then freely watering. To no avail however, no blooms will appear until natural rainfall comes. When the rain comes the buds will appear as if by magic. The city-supplied water is very alkaline and full of minerals and it may be that it lacks the necessary stimulant to force flowers to appear.

The white crocus-like flowers of *Z. candida* appear during September. The bulbs multiply readily and set seed freely. The foliage does not remain in good condition under the summer sun but where grown in semi-shade it is more satisfactory. The flowers appear but once. More satisfactory if once established is *Z. atamasco* with much larger flowers. It has been grown here for but one season but appears to be prepared to grow and flourish.

Z. texanus is a native bulb, the flowers are yellow, with copper reverses and some varieties show purple veining in the flowers. Other native zephyr lilies are not particularly showy unless grown in sufficient mass. They often make a vivid showing after a late summer rain, being all the more welcome because nothing else is blooming in the vacant lots and outskirts of town. By far the most satisfactory of the yellow zephyranthes tried out thus far is *Z. citrina*. Blooms appear in August and continue until September is nearly gone. The color is a vivid yellow that positively sparkles, and the flowers are so numerous that a dozen bulbs will make a noticeable spot of color. No sooner has the first set of flowers faded than the second and third open, seed is set freely and germinates quickly. The zephyranthes have a real future here.

Allium Neopolitanum blooms in February providing pretty heads of loose white flowers good for cutting or in the garden. Its worst fault is

lack of stamina in the flower stem. Other *Alliums* flower later but are usually in the white varieties, the colored types are rarely grown.

The only alstroemeria that really establishes itself here is *A. pulchella*, more exotic than beautiful. It spreads both by seed and root, appears quite hardy. When shipping conditions are improved other species will be tried, at present it has proven impossible to get the roots intact through the mail.



Fig. 150. Flowers of Selina Foster Daylily.
Photo by Paul A. Kane.

Agapanthus grows well but flowers rarely. Occasionally one comes into bloom but they are not reliable as to bloom.

Chlidanthus fragrans is chary of flower, the bulbs persist but rarely flower after the first season. The bulbs split up so much it is likely that the flower has no chance to form.

Sprekelia formosissima gives one exquisite blossom to the bulb, beautiful enough to pay for its years use of the garden space. It never sets seed but has made offsets.

Cooperia pedunculata and *C. drummondii* are on their native sod, they bloom after every rain from early spring until frost. The flowers are white, tinged with pink as they age, and the fragrance is such that

these should be grown in every garden. In the fields the bulbs are sometimes more than fifteen inches underground.

About the most popular of the *Amaryllis* family are *Hemerocallis*. The gardeners of the vicinity are beginning to try out some that are but distantly related to *H. fulva* and *H. flava*. Even now visitors stop to ask the identity of *Vulcan* and marvel that it is a daylily. The long growing season gives many a daylily a chance to send up another set of bloom stalks. Even a newly set plant may do this. Beginning with *Gold Dust* and *Gracilis* in early February, the daylilies bloom the entire year ending with *Gold Dust* and *minor* repeating until after Christmas.

Among the favorites in this garden are *Mrs. A. H. Austin*, with very large golden flowers, and attractive *Serenade* with pastel shadings. Two-toned beauties such as *George Yeld*, *Boutonniere* come in for appreciation.

Vulcan, *Theron*, *Indianola*, and *Stampede*, are good reds for this section although all of them do best grown in partial shade to avoid baking out the color pigments. *Blazing Star* has good color but the form is indifferent.

The best yellows tried out so far have been *Dauntless*, *Modesty*, *Starlight* and *Patricia* with some local seedlings bearing real promise.

H. fulva rosea and the clone *Rosalind* while not yet established will be found satisfactory because the color and form are both good. It was discovered (though probably known elsewhere) that planting the pink daylilies near cream or very pale yellow flowers showed off the pink coloration to distinct advantage.

Calypso is the finest of the evening bloomers tried out, the blossoms keep open well into the next morning. Another that will bear watching is *Citron Bell* by Eddie Fanick, local iris grower and daylily breeder. George Allen and Harry French have other good seedlings.

It is certainly noticeable that the orange and fulvous colored daylilies are definitely not in favor in San Antonio and vicinity. However, there are fashions in flowers as in other articles and the pendulum will swing back again. Certainly a splash of tawny orange can do much for the fall garden. *Dawn Play*, *Chengtü Vesta*, *Bardeley*, *Margaret Perry* are definitely on the wrong side of the fence. Even some of the near reds go more orange, perhaps because of the sun. The good point of many yellows is that the fading caused by the sun is not unattractive.

Mikado is the most widely planted hybrid, with *Calypso*, *Ophir*, and *Hyperion* in that order as nearly as can be determined.

A bright red daylily that will keep its color under Texas sun would really be an achievement, and one that would do much to bring the daylily into every garden.

In Figure 150, flowers of the *Selina Foster* Daylily are shown. This is described under Registration of Daylily Clones in the present issue of *Herbertia*.

EXPERIENCES WITH AMARYLLIDS ON THE TEXAS PLAINS

WILLIE MAY KELL, *Texas*

It is easy to grow many amaryllids here in North Central Texas if one can spend the time and effort necessary to mature the bulbs properly by supplying moisture in those seasons when the rainfall does not come at the right time. The ones too tender to live through the winter are easily potted and cared for until danger of frost is over, for spring comes early and winter very late, making the time short for indoor care. Amaryllids are easy to care for by burying the pots containing them in the garden in the summer. The bulbs cultivated here are grown under conditions much less favorable than most locations in this community—a small city lot at the top of a clay hill, where the air drainage is extreme when a “blue norther hits.” When a “pocket handkerchief garden” has four large hackberry trees, fifteen pecan trees, two jujubes, several albizzias, other small flowering trees, a large Amur River privet hedge; not to mention clumps of bamboo, intersecting hedges of thirty year old crepe myrtle and pomegranate, as well as such shrubs as vitex which grow to tree size, the competition is quite keen as an old colored man expressed it. A florist, who has a greenhouse just a few blocks west of here, facing south, gives but little care and attention to his plants and yet they survive when the same varieties are frozen at this location. Our irrigation system has been ruined by many abandoned salt water wells which are another handicap at the present time. The annual rainfall for 1943 was 14.45 inches and very little of that came during the growing season and for 1944 it was 15.57 inches of which only 11.65 fell before the middle of September. There was a good fall season this year, and now the new year starts with a sufficient moisture content of the soil. And there is a promise of a new irrigation system free from salt before the year is out. Spring may bring a burst of bloom from many bulbs to repay all the time and effort spent on them.

My successes and failures with amaryllids on the north central Texas Plains are briefly summarized below.

ALSTROEMERIAS. *A. pulchella* does well without protection, provided that it is planted in a semi-shady location. It even had a few blooms this fall when rains came early. Other species have been tried without success but are being tried again this season, both plants and seeds.

AMARYLLIS. *Amaryllis advena* is an iron clad plant here. It blooms and multiplies along a cement driveway where the intense heat of the Texas sun beams all day. Then it brings in the month of September with its brilliant red flowers, regardless of the severity of the summer heat and drought. The pink variety of *A. advena* promises to perform as well, but starting with four of these in comparison with one hundred of the ox-blood red variety, it will take some time to make a comparable show. *Amaryllis belladonna* Linn., is represented by two

species in this collection. These are very different in hardiness, color of flower and in leaf growth. The tender one comes from very old stock and has always been treated as a pot plant even in much warmer parts of the South. It is kept growing without any rest period. The flower is a salmon with the characteristic green star in the throat. It seeds readily. The seeds are very easy to germinate and grow to flowering bulbs quickly. The other is a hardy, strong growing species. It was purchased and planted in October of 1940 and has flowered each spring and multiplied in a bed where one dozen fine hybrids died the summer of 1944 for lack of moisture after blooming. The color is red with a tone of yellow. It also forms seeds easily and they should be true as there is no other *Amaryllis* in bloom that early in the season.

The hybrid *Amaryllis Johnsoni* is a common and hardy variety throughout the South. Once planted and left alone it establishes itself and multiplies by forming offsets although it does not form seeds.

Amaryllis solandriflora conspicua does well here. It seeds readily as do also the hybrids of *A. ambigua*. It was planted outside and lived for three winters but the summers of 1943 and 1944 were so severe in heat and with no rains after blooming, and no power was available to water enough to mature the bulbs, that it was not making good leaf growth this fall (1945). It was potted and will be fed this spring, once it starts to grow. The hybrids were left outside and so this winter should show what they will do. There are also a variety of other *Amaryllis* hybrids in the collection, including representatives from the Royal Dutch, Hermon Brown, Mead, Rice and Howard & Smith strains, besides others bought in pots when in flower, but not identified as to strain. In the fall of 1944, some of these were potted after the first killing frost and grown in pots. When spring came they were fed and watered well after flowering, then the pots buried in the ground all summer. After killing frost this fall they were lifted but had to be repotted as they had grown in size and formed such long roots that larger pots were required. December brought some heavy freezes that do not usually occur until January or February. Therefore "winter overcoats" were put on the choice bulbs. The method used for hybrid *Amaryllis* was to cut both ends out of three pound coffee cans, place these over the bulbs and then fill with propagating sand. The potted plants were all put down in a cellar. This method saved many in one winter when there was a sixty degree drop in a few hours. Three hybrids, the first tried, planted in the spring of 1936 were apparently placed in the right location for they have done well even though they receive no more attention than the rest in a closely planted bed. They have not increased for in each year the flowers have been cut for some admiring friend. The three hybrids produce large brilliant red flowers, superior in form and color to some obtained later. As yet there are no whites or even near whites. A refund has always been made on plants purchased as whites or near whites for they always turn out untrue to the descriptions. One even proved to be a seedling *Crinum*.

BRUNSVIGIEAE. *Brunsvigia alba* was planted in September 1945, and the bloom stalk soon appeared. When cut and placed in water

it opened well and lasted a long time. *Brunsvigia rosea*, varieties *major* and *minor*, never flowered, except the first year of planting. The hybrids, *Brunsdonna Multiflora*, *Hathor* and *Parkeri* have lived but have never flowered except the first year after planting. After reading in HERBERTIA that Brunsvigias and Brunsdonnas need to make a winter growth of leaves, a new method is being tried. *Crinodonna Howardii* was obtained at three different times but none flowered. The last obtained have been potted and are now making good leaf growth. The others have lived out-doors, made leaf growth through the summer until killing frost, but have not flowered.

Several species of *Nerine* added to the collection from time to time, are still living after three or four years but none have ever bloomed.

The collection originally included *Crinum amabile*, *C. americanum*, *C. augustum*, *C. bulbispermum*, *C. campanulatum*, *C. erubescens*, *C. giganteum*, *C. Kirkii*, *C. kunthianum*, *C. Moorei* var. *alba*, *C. scabrum*, *C. zeylanicum*, *C. pratense*, *C. fimbriatulum*, *C. virginicum*. The ones that did not survive are *C. pratense*, *amabile*, *fimbriatulum* and *giganteum*. Their disappearance may be due to lack of care before they were established. *C. zeylanicum* was the only one that froze. The form of *C. bulbiferum* in the collection has no ornamental value but it does seed easily and will make it possible to carry on *Crinum* breeding. *C. Moorei* is the most ornamental in the group. Some have not been established long enough nor have they flowered long enough so that they may be evaluated. The hybrids represented here include *Crinum Cecil Houdyshel*, *Ellen Bosanquet*, *J. C. Harvey*, *Krelagei*, *Louis Bosanquet*, *Peachblow*, *Powellii Alba* and *Rosea*, *Sophia Nehrling*, *Virginia Lee*, *White Queen*, and *Frank Leach*. These are all choice ornamental plants, and all have flowered except three that have been newly planted, including *Sophia Nehrling* which may be worth the wait. There are also nine unidentified *Crinums* that were purchased under many different names, from "Lily," "Amaryllis," "Brunsvigia," etc. One is a large "Milk-and-Wine-Lily" type, which shows its first blooms along with *Regale lili-ums*, and makes a lovely flower arrangement with some pale yellow day-lilies (*Hemerocallis*). This blooms through the summer, forms large clumps and is iron clad. Another is much smaller growing, has a more refined flower and is a good bloomer. It often has the fourth recurrent flowering period by the middle of July. The only fall-blooming one among them is called "Angel Lily," and has a lovely fragrant flower. *White Queen* flowers early with many flower scapes, that appear in rapid succession. So far *Peachblow* has had only two flower scapes in a season but the flowers are so beautiful that they are worth waiting for. *Crinums* do well and flower regardless of conditions here. There is such a wide range in color and type that they make a great display.

PANCRATIEAE. *Eucharis grandiflora* has been treated as a pot plant, but its flower is so choice and comes at a time when there are no other bulbs in bloom, and one is therefore well rewarded for the extra work. *Elisena longipetala* was added this fall and has not as yet flowered. *Pancratium maritimum* also has to be treated as a pot plant to flower here. When planted out of doors, the warm open winters induce

it to sprout and then the March freezes catch it too far advanced. The native American *Hymenocallis* are so badly mixed up as to names as a rule that it is difficult to report concerning them. *H. caribaea* will not live here. *H. occidentalis* is being tried for the first time this year. However, there are some hardy ones in this group that seem to be as easy and robust as *crinums*. Some are quite large, some quite small. As they bloom off and on all summer, they are a real addition to the garden. If the flower is cut before the heat of the day when the first flower of the scape is ready to open, it will last well, and the remainder of the flowers will open up. *Ismene calathina* did well for several years with beautiful flowers but after our sixty degree drop in temperature failed to bloom and some died. The hybrid, *Sulphur Queen* has flowered only in one year, and the hybrids *Advance* and *Festalis* did not live. This apparently was due to planting in winter during severe weather.

GALANTHUS. These are not worth growing here. *Galanthus Elwesii* and *nivalis* have been tried, but they are always stunted by spring freezes so that they bloom with such very short stems. There are many other spring-flowering bulbs that do so much better under the conditions here that *Galanthus* suffer by comparison. On the other hand, the related *Leucojum* are lovely spring flowers and are iron clad subjects here. *Leucojum aestivum* and *vernum*, though obtained under these names are apparently the same. There is a very different form (Gravetye Giant) that came to me from California where it is quite common. This has a very much larger flower and the leaf is quite flabby and a bluish green, nearer the color of the *Narcissus* leaf.

IXIOLIRION. *Ixiolirion tataricum* is a small and pale colored flower as it grows here, and does not live up to the descriptions as grown farther north.

ZEPHYRANTHEAE. The native Texas *Cooperia Drummondii* and *C. pedunculata* do well here although they are not native in this region of the State. They bloom off and on all summer. *C. pedunculata* is far superior in every way to *C. Drummondii*. The others *C. kansensis*, *C. Traubii*, *C. albicans*, and the yellow-flowered, *C. Smallii* have not as yet been tried.

The collection includes *Zephyranthes atamasco*, *citrina*, *grandiflora* and *tubispatha*. *Z. candida* was dug and given away as it is too invasive with a dirty white flower that had no cut flower value. There may however be better forms of this available. *Z. atamasco* has just been planted. *Z. citrina* is small and less desirable than *Habranthus texanus*. *Z. grandiflora* and *Z. tubispatha* are lovely little flowers that bloom during a very long season. There is another species of *Zephyranthes* that was collected for me but it has never bloomed. It was recently transplanted and found astonishingly deeply placed in the soil.

Sternbergia lutea major has a large flower that opens out wide although the scape is short. *S. lutea*, the type, has a longer scape but the flower is smaller and does not open wide. They are quite hardy and form good clumps which make a showy border, even though the leaves are lacking.

All the *Habranthus* species tried do well here. *H. robustus* is a

beautiful little flower, *H. brachyandrus* is a more robust grower and seeds readily. *H. Andersonii* and *H. texanus* are good in color but are so tiny.

Sprekelia formosissima has never flowered except the first year. This fall they made good strong growth before the freeze came so that perhaps they may bloom this spring.

HAEMANTHEAE. *Haemanthus Katherinae* is the only one that has flowered here. What a thrill when one sees for the first time this large and brilliant flower. These subjects are not hardy here and have to be treated as pot plants as was learned by sad experience. *H. albiflos* and *coccineus* are also under trial. The first purchased was a very strong and choice bulb with a bloom large in size and beautiful in color. It was planted on March 1st, flowered for the first time July 2nd of the same year. There were two mild winters so it lived and bloomed and did well until January of the third year when a low of 2 degrees above zero Fahrenheit hit. It was covered but was not sufficiently protected for such a hard freeze. The bulb was taken up immediately and potted but it looked very bad as it was in leaf when frozen. In January of the following year it was repotted after being treated with hormone powder, in a potting mixture of sand, peat and manure. This January it is beginning to leaf out and looks vigorous once more. The other two species have only recently been obtained.

Clivia miniata hybrids and the hybrid *Clivia Zimmermanni* are grown as pot plants, buried outside for all summer. They flowered well until 1944 and 1945 when so many amaryllids failed to bloom.

LYCORIS. These flower in the fall when most of the other plants are either through blooming or have not as yet flowered. They seem to suffer from drought and not from freeze. *L. aurea* is a brilliant flower to cut and arrange with other flowers. *L. radiata* (type) is a brilliant show when in bloom in the border. *L. radiata* var. *alba* and "*L. incarnata*" as obtained from a firm are identical. The latter is apparently not the true *L. incarnata* for Col. Grey describes it as being very different in color, and observes that it is reported as "so brilliant as to defy the skill of any artist." *L. radiata* var. *alba*., now available commercially, is a lovely greenish cream flower with a touch of red on the edge of the segments, but could not be described as brilliant. *L. squamigera* is temperamental here—sometimes it blooms, sometimes not. *L. purpurea* has never flowered here but a bulb of it recently acquired was potted and is now making good leaf growth.

CHLIDANTHUS. *Chlidanthus fragrans* is a hardy bulb here. Its fragrant and lovely yellow flowers are a worth while addition to any garden.

NARCISSUS. The collection includes the hybrids *Diotima*, *Ben Hur*, *Mrs. Krelage*, *Mrs. Backhouse*, *Thalia*, *Acatea*, *King Alfred*, *Diana Kasner*, *Glory of Lisse*, *Laurens Koster*, *Soliel d'Or*, *Tazetta*, *Grand Monarque*, *Campernelle*, *White Lady*, and old stock acquired from gardens of my friends' grandmothers. If grown well and given care, most *Narcissus* will do well here. But they have to be fed each spring after flowering as our soil is not fertile enough to produce good blooms otherwise.

NOTES ON PYROLIRION FLAVA

GEORGE H. HAMOR, *Dominican Republic*

To persons interested in the smaller ornamental amaryllids, *Pyrolirion flava* offers some interesting features, not the least of which is its large and highly decorative flower.

In May, 1942, there arrived from Peru six medium sized bulbs of *Pyrolirion*, described as "*Z. flava* or one of its varieties." Two of the bulbs flowered six days after planting, but the cultural requirements were unknown and through bad luck, or perhaps poor judgment, the conditions provided were unsuited and for several months the survival of the plants was doubtful. By way of trial and error the necessities of the species were worked out at last and since then there has been a good deal of increase.

No exact tests have been carried out to determine the optimum conditions for growing the plant, but a soil fairly fertile and around the neutral point is perfectly satisfactory; its limits of tolerance above and below that point are not known definitely but the range is probably fairly wide. The soil should be at least fairly light and perfect drainage must be provided; the bulbs will decay if kept too wet. Preparation should be rather deep as the fleshy roots have a way of growing straight downward.

Here, at sea level in about 18 degrees north latitude, the species thrives in full sun and dislikes more than a very light shade. Native to a region of pronounced dry and rainy seasons, by preference it should be given growing conditions approximating those of its native habitat. We have an abundance of water for sprinkling together with the type of yard men who have difficulty remembering what to water and what to leave dry. The result has been to give *P. flava* most of the time the treatment of a tropical evergreen but unlike many *Zephyranthes* species—*carinata*, *citrina*, *insularum*, *rosea*, etc.—which remain green the year around if watered, *Z. flava* possesses little adaptability in that respect. To the contrary, after a certain period of growth the foliage dies down and the bulb goes into a dormant condition in spite of any amount of watering. Bulbs have been kept out of the ground nine months without appreciable deterioration, and when planted after a long rest period flower almost immediately.

Bulblets have been sent to a few correspondents in the U. S. A. and experiences there check perfectly with the assumptions that may be made by considering the habitat of the plant. It is definitely tropical or subtropical and cannot be expected to stand any degree of frost, nor is it likely to survive in heavy soil kept constantly wet by rain and fog during the colder months even though the temperatures do not drop close to the freezing point. In regions having that kind of winter weather the bulbs should be treated as *Gladioli*, or better still kept planted in fairly deep containers, allowed to dry out completely at the end of the growing season, left in the containers with the soil and moved inside.

A complete description of the species is left to the skilled botanists but for those who may be interested in the general features the following will suffice.

Bulbs with light brown or grayish tunic, to $1\frac{1}{4}$ in. diameter and 1 in. high, neck short, stoloniferous; leaves to 7 or 8, light grayish-green (gray tint more pronounced in alkaline soils), 10 in. long and $\frac{3}{8}$ in. wide; scape on strong plants to 15 in.; flower trumpet-shaped, bright orange-yellow, $3\frac{1}{2}$ in. diameter; ovary sessile, no seeds. Attempts at hand pollination have failed here as have attempts to cross with other species.

PROTECTING WRITING ON GARDEN LABELS

J. S. COOLEY, *Maryland*

All gardeners know how disconcerting it is to be unable to find the name of a plant because the writing on the label is effaced or the label is lost. Durable metal labels are expensive and are probably unobtainable at the present time. Most of the recommendations for preserving labels are so complicated or expensive that people fail to use them. The writing on wooden labels, even painted ones, may soon become illegible if it is exposed to the weather. The writer has found that by placing the face of the label against another label or against a larger stake, the writing remains legible for at least 3 years, while without such protection from the weather, the writing may not be legible for as long as one year.

Wooden stakes and labels may rot or be destroyed by termites in a surprisingly short time. Marking stakes, that are not used to write on, may be protected against decay by treating them with crankcase oil. Decay of labels may be delayed by soaking them in a concentrated solution of copper sulfate. Heart cypress and Redwood stakes usually last for years without any treatment.

No matter what type of labels one uses it is wise to have something to fall back on in case the writing becomes effaced or something should happen to the label. This may be accomplished by making a chart or map of all important plantings. Care should be exercised to have the chart tied in with some permanent object, in which case even a very crude chart may be very useful in locating a variety. The chart should always be put in a garden book or where other garden data are recorded so that one can always locate the map, even though the pages of the book may be too small for as elaborate a map as one would like. When plants are set in rows, as in a nursery, mapping is easy and a very effective supplement to labels.

AMARYLLIS ON ASCENSION ISLAND

EDITH BAUER STROUT, *California*

Flowers seem so plentiful in most places of the world that I have wondered in times past if they were more appreciated in desert spots when there were only one or two available. I know they are appreciated and it is certainly surprising to find them on an ash heap, as I did when I visited Ascension Island, in the middle of the South Atlantic Ocean.

This island is one of the new creations, volcanic, with not a bit of vegetation on the lower slopes of the island. The high peak, Green Mountains, reaches up into the Trade Winds, and as a result gets some moisture from the clouds, mostly dew. When the island was used as a Naval Station to guard St. Helena when Napoleon was sent there, a "farm" was started on the top of the mountain to supply green vegetables, and support some cows.

Englishmen are noted for their love of flowers, and to be stationed on this barren island must have been a very trying experience. Sometime during the past, someone who loved *Amaryllis* brought two of them to the island, and they have flourished and multiplied ever since. Now there are many of these two varieties raised on top of the mountain to furnish bright bouquets for the homes on the barren beach. When I came there in late April, they were in full bloom, and I was amazed to see stalks of *Johnsonii* with 6 to 7 bells all open at once, and I've been an avid *Amaryllis* fan ever since. The other *Amaryllis* is an *A. belladonna* Linn. [non Ait. ex Herb. (syn. *A. equistris*; *Hippeastrum equestre*)] hybrid, with very pointed petals, salmon colored with white star in the throat. They are planted in free soil, bulbs covered to the necks, and of course heavily fertilized with cow manure. All the soil is volcanic ash with humus added, and on the top where they grow there is little full sun, a cloud usually covering the peak itself. Though grown over two thousand feet high, it is never really cold up there though due to the fog, sometimes chilly. But here they thrive and bloom to bring joy to the hearts of people far from home.

MY EXPERIENCES WITH DAFFODILS

ELEANOR D. BENNERS, *Texas*

To begin with, mine is the garden of an amateur (in Dallas, Texas) who is interested in many garden subjects. No hybridization of daffodils has been attempted, though admission is made that such work has had its appeal; six years from seed to flower did not encourage that interest, since time has been at a premium for some years with me.

It was a very warm day in the late daffodil season of 1935 when a visiting daffodil specialist said to me, "I am afraid that your garden is going to prove too sunny." She, just out from California en route to her home in Michigan, was perhaps justified in that assumption. Panic seized me; but undaunted enthusiasm returned, without diminution; for,

as has been said, only women try to do the impossible, even under proven (?) impossible conditions. "Too sunny"—the heat was undeniably discouraging for the moment, and was an annual prospect; but surely, I thought, something could and must be done to obviate its intensity. Fortunately the house and trees on the west throw their shadows in the afternoon, and the protection of hedges and flowering shrubs has been of further assistance, and therefore the daffodil venture continues.

In commenting upon the gardening interest that had just begun to sweep the country at that time, a well-known Texas jurist facetiously said, "— it is a mild form of insanity, incurable, but not fatal." We might change the wording of that thought somewhat and say rather that "gardening is a progressive, pleasant disease; an insidious one, awaiting only a right germ to bring on an attack; acute and incurable, but never fatal." So it was that fifteen or more years ago there burst upon my vision a hitherto unobserved and neglected clump of daffodils in full bloom, looking like nothing so much as a flight of white butterflies, as the scapes swayed to and fro in the early morning breeze. At once I succumbed to the spell of their beauty, and knew that another cycle of new and specialized garden interest had begun.

In 1929 some fortunate chance impelled membership in a plant society; I was at once interested in some of the daffodils so beautifully illustrated in the journal furnished, which I determined must be found for my garden. I knew that to be successful with them, I had to learn how others succeeded in the same line. I sent for advertised lists and pored over each as it came. How well I recall the first specialized list from the late Mr. Franklin B. Mead. What a thrill and what shock was mine as I read the descriptions—and noted his prices! Alas! before I could decide which were *musts*, he passed on. Soon I knew of other specialists. I felt that the first thing necessary for success was to start out with good bulbs and that the best would probably be found in a specialist's planting.

While bulbs were gradually being acquired, a few each year, the study of narcissi continued. Much was being written on the subject at the time, and having known of Mr. Sydney B. Mitchell's work with irises, and his early hybridization of daffodils, when *From a Sunset Garden* came out, the acquisition of this book served a double, or I should say, a manifold purpose, in that, aside from other subjects, a veritable mine of interesting information was found in the chapter on daffodils.

As interest grew, more specific knowledge of the botanical relationships of the daffodil was sought. To this end *The Narcissus* by Mr. E. A. Bowles, an English authority, was read. In the meantime a little monthly magazine put out by the Garden Club of Virginia came to me, and I learned much of different varieties of daffodils exhibited at the Alexandria Shows. That was when the late Mrs. Harris was chairman of the Narcissus Group. Her suggestions as to varieties were most valuable. All this time my collection was growing, little by little, and I read avidly everything I could find on the subject.

So much for the background of an experience which I believe to have been entirely new in this locality at the time. This is not to say that daffodils (commonly referred to as "Jonquils") were unknown in Texas. Many of the very old varieties probably came out in covered wagons and have grown on under the handicaps of wind and weather, but feebly, and those that survived have apparently long since been forgotten as to name. For instance, I was the lucky recipient of a box of small bulbs sent from Northeast Texas. The sender said: "I've no idea what these are. They've been in this garden forever." They were, I found when blooming time came around, of all things—*N. gracilis*! A precious little thing of ineffable sweetness that had found the right conditions of soil and moisture in that corner of Texas. I have found them very exacting in these requirements. Have you lilies of the valley or myosotis, then plant *N. gracilis* with them. I am hoping that I can make them at home in my garden for a long and indefinite stay.

The soil of this fifty year old garden is naturally heavy and black, but much additional soil of a different texture has continually been brought in as was thought needful. The surface drainage of the lot is plentiful, but bulbous and rhizomatous materials need, in addition, adequate drainage underneath, so that no water may stand around the bulb or bulbs. In this connection it has been found better to have planting positions properly prepared in advance of planting time. This is not only easier, but makes for better planting by reason of giving the soil time to settle after deep digging (for drainage) and the addition of sand, rotted fertilizer, either dairy or cotton seed meal (or hulls), with a liberal sprinkling of ashes, preferably from hard wood. The fertilizer as above, should be mixed in well beneath the approximate depth of the planted bulb and in the surface soil a liberal sprinkling of equal parts of bone meal and superphosphate should be worked in.

When the actual planting time (September 15-October 15) arrives, a two inch base of sharp sand is placed under bulb or bulbs and they are surrounded by sand also so that no possible contact of bulbs with any kind of fertilizer may occur. The bulbs are planted generally about six inches deep, depending upon the size of the bulb, and after filling in the soil, water is applied, so that settling of the top soil may be accomplished as soon as possible. Afterwards no further watering is needed, except perhaps after growth has started, if it be very dry and the winter rains have not started. Another light sprinkling of equal parts of bone meal and superphosphate to the entire planting may be added the last of December or the first of January. My bulbs remain in the ground without lifting and storing—this is the method of an ordinary gardener, one without professional help of any kind. The number is many, and strength is unequal to the task of lifting, storing (in dry sand) and labeling.

Whence do all these bulbs come? From California, Oregon, Washington State, Ohio, Michigan, Maryland, Virginia, Tennessee and Ireland. Amazingly the long jump from Ireland to Texas was successful for the larger number, produced very good bloom the first year down. I believe that *Brunswick* was the least friendly to this change, and next

Nelly. A much prized addition to my collection came in 1937 when I was the grateful recipient of a box of fine bulbs sent by Mr. B. Y. Morrison from his garden in suburban Washington. From these various sources, in extremes of distance, there has been little appreciable difference in the size of bulbs. All good bulbs, the large round ones, give on an average two fine blooms, and the double-nose bulbs sometimes produce three. Occasionally bulbs from the Northwest have been larger and have produced larger blooms the first year down. That distinction does not always hold for succeeding years. Some from any section may fail to bloom the second year, though fine healthy foliage is produced. This failure I have attributed to a bulb not being acclimated.

I have made no attempt at listing varieties—there are too many. They have been acquired gradually over the years, a very few of each at a time—never more than one, two or rarely three. A variety's natural increase makes for a reasonable restraint in the number bought.

I have seen no indication of disease amongst my bulbs, unless it be a sometimes twisted foliage noticeable in the lovely *N. triandrus* and *N. Tazetta* cross, *Silver Chimes*. Casualties occur in every planting and I've had my share, some unavoidable, others that were the result of careless work or forgotten positions. My husband, as fond of the garden as I, often turns up a handful or more of bulbs when trying to find space for some herbaceous favorite, and exclaims, "the garden is *pizen* with bulbs!", replaces them as is—and they may or may not be seen again.

On the whole, I should say emphatically that selected early and properly planted in well prepared, semi-shaded soil, there is no reason why daffodils may not be well grown in Texas, and in numbers.

CULTURE OF PAMIANTHE PERUVIANA

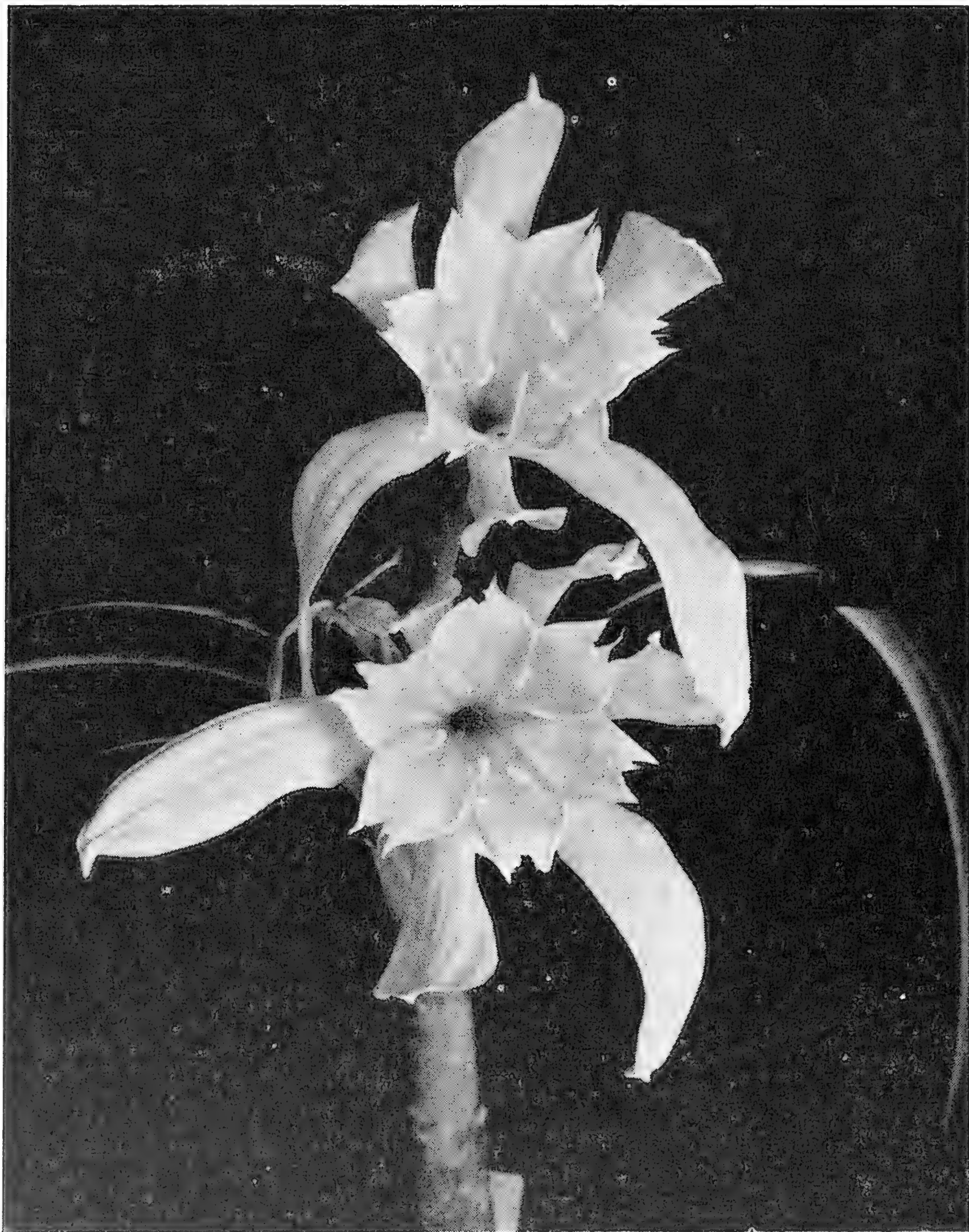
W. M. JAMES, *California*

Pamianthe peruviana has proved too tender to grow out of doors in Southern California. It took a plant growing in the open ground at Santa Barbara about three years to die and one at Ojai about the same length of time.

The illustration (Plate 283) shows a plant which was grown in a Cattleya house in Santa Barbara. The flowers were hand pollinated and set seed readily. The seed germinated very well and the seedlings were easy to handle as long as they were in the orchid house.

When the seedlings were about one year old, the Cattleyas were sold, and the house dismantled and rebuilt into a smaller one with no heat. Under these conditions, both the seedlings and the parent plant died in about two years. The plant made one attempt to flower in the new house, but there was only two small blossoms which barely got out of the neck of the bulb. This flower was probably initiated in the warm house.

The flower is very attractive and well worth growing. It will probably never be found to any extent in Southern California because there are so few glass houses which are kept warm enough.



Pamianthe peruviana.
Photo by W. M. James

The plant is a little different in appearance than most of the amaryllids of its type which we are accustomed to seeing in this section. There is scarcely any swelling at the base of the leaves, so that there is no large bulb as in *Amaryllis*. The base of the bulb grows on top of the ground so that only the roots are covered. The parent plant grew vigorously in a mixture of sandy loam and humus. The root system is strong growing and probably needs more room than is given to an *Amaryllis* bulb with comparable leaf surface.

NOTES ON CRINUMS

A. C. DELKIN, *California*

Crinums have been my hobby for over a decade, and I have acquired all species and hybrids of this genus that I found in trade catalogs. Some were not suited to this location. A few very tender species have been kept in the greenhouse in winter for my place is not a frostproof location. However, the larger bulbs, such as *Crinum asiaticum*, are too difficult to move around on account of the huge size they attain.

The species and hybrids that are hardy out of doors without protection, even when planted at a very shallow depth, are—

Species. *Crinum bulbispermum*, white and pink varieties; three kinds of the Milk-and-Wine-Lily type, *C. Kirkii*, *C. erubescens*, *C. campanulatum*, and *C. Moorei*.

Hybrids. *Powellii album*; *Cecil Houdyshel*, *White Queen*, *Ellen Bosanquet*, and *Louis Bosanquet*.

One of the best, and beautiful of all the crinums, easiest to grow and most rapid multiplier by offsets, is *Powellii album*. One large bulb planted at a shallow depth, and well watered in my sandy soil will produce 12 or more offsets in a year. They will not bloom if planted deeply. Large bulbs planted at a shallow depth will average three bloom scapes each per year. My collection contains over 5,000 clumps of this clone. They are a beautiful sight when in bloom. When I decorate with them most people refer to them as Easter Lilies. This is also my wife's favorite cut flower for it is beautiful and long-lasting.

I have several thousand *Crinodonna* (*Amarcrinum*) bulbs which produce flowers varying from almost white to deep pink. They make excellent cut flowers.

White Queen (Burbank) is a fine subject. It is however slow to increase by offsets, but does set seeds. *Ellen Bosanquet*, an unusual wine red, is an important member of my collection, as is also *Cecil Houdyshel*, an excellent pink.

CULTURE OF AMMOCHARIS AND CYBISTETES

L. S. HANNIBAL, *California*

Several years ago the writer received several bulbs of *Ammocharis*. At the time little factual information could be found regarding their culture, and although the bulbs occasionally put out a leaf stub, they did not seem especially happy in their pot. Eventually the timely article by

Milne-Redhead and Schweickerdt turned up (Journ. Linn. Soc. Bot. Vol. L11 Pages 159-197) and from the information that they give it is apparent that these plants are a winter growing—summer resting type. However, since they are usually located in areas of scant rainfall the leaf growth only appears when conditions are favorable. With a warm dry spell the leaves soon dry up, but with the next rain the stumps begin regrowth and may last for a period of several weeks to three months.

Translated into central California conditions we soon found that leaf growth came during the fall and again in the spring—the optimum conditions being when the nights held between 50-60° F. When planted

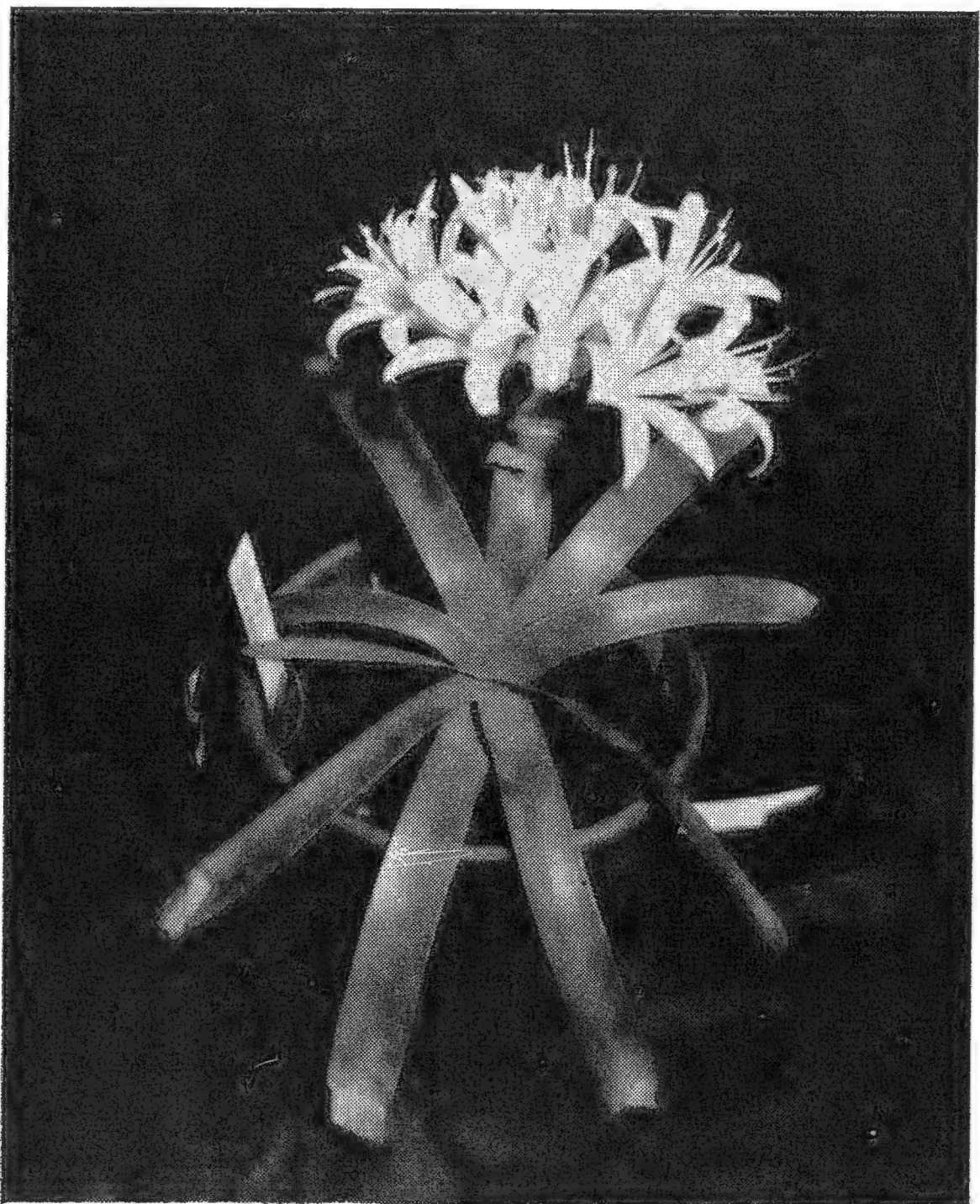


Fig. 151. *Cybistetes longifolia*. Photo by Perry Coppens.

in a raised outdoor bed containing considerable sand and gravel for drainage the plants soon become established. The partial shade of a deciduous tree seemed conducive to better summer foliage on the bulbs, a condition which Mr. James first called to our attention, but with the slightest frost in winter the foliage promptly dies back, only to start regrowth with a few warm days.

The first species we had was *Ammocharis heterostyla*; this had been introduced into our Florida trial garden as *Crinum amموcharides* (A

208) by the Lady Muriel Jex-Blake. It is an extremely local type found only in the immediate area of Mt. Elgon in Kenya Colony. The U. S. D. A. also has imported a number of the same bulbs and some small stocks are now available at several sources. Mr. James featured a picture of a clump in flower in *HERBERTIA* Vol. 10, page 157. This bulb sends up two scapes each fall. The flowers are quite interesting, resembling a dwarf *Crinum asiaticum*, but are not spectacular.

Later we obtained some small bulbs of *Ammocharis coccinea* and *A. coranica*. According to Milne-Redhead *coccinea* is a misnomer and both plants should be considered *coranica*. This plant is found only in the immediate Cape area and seems quite variable in color or form. Its culture is identical to that for *A. Heterostyla* and the plants appear about equally hardy.

Cybistetes longifolia was received under the old name of *Ammocharis falcata*. Its foliage differs only very slightly from that of *Ammocharis*—the leaves are a bit wider and do not tend to hug the ground so closely, but are so similar that under normal conditions only a person especially acquainted with these plants can segregate the two without seeing the flowers. The separate genera proposed by Milne-Redhead for these two bulbs make a distinction based on flower structures—that of *Ammocharis* having actinomorphic or ray formed segments, while the other is zygomorphic or bilaterally symmetrical.

A NONPARASITIC LEAF SPOT OF THE DAYLILY

J. S. COOLEY, *Senior Pathologist*

Division of Fruit and Vegetable Crops and Diseases

Bureau of Plant Industry, Soils, and Agricultural Engineering

Agricultural Research Administration

U. S. Department of Agriculture

In the summer of 1942 a seedling daylily (*Hemerocallis*) growing at the Plant Industry Station at Beltsville, Maryland attracted the writer's attention because of the abundance of leaf spots. This plant showed severe leaf spotting in May. As the season advanced a similar leaf spot was observed on many of the named varieties at the Plant Industry Station and also in the plantings of named varieties of several growers in the vicinity. From conversation with daylily growers in other parts of the country it was learned that a leaf spot apparently similar to this one occurs in other sections. Some varieties show considerable spotting and others very little or none.

The spots (Fig. 152) are quite variable in size and shape, the diameter ranging from one millimeter to more than a centimeter. The margin is usually, but not always definite. In color the spots vary from a greenish yellow in the early stages to a reddish brown as they become older. Russet Spot is proposed as an appropriate name.

In October 1942, a species of *Vermicularia* was isolated from the older spots. *Vermicularia liliacearum* West., has been reported as occurring on dead or dying leaves and bloom scapes of the *Hemerocallis*.

As the spots occurred in definite patterns on living foliage, and the *Vermicularia* was found fruiting abundantly on old lesions it seemed important to test the fungus for pathogenicity by artificial inoculation.

Following this observation, a few plants of the susceptible seedlings were lifted, thoroughly washed, stripped of all foliage and potted for



Fig. 152. Showing abundance of russet spot on upper and lower sides of daylily leaves.

greenhouse study and inoculation experiments. When new foliage appeared, inoculations were made, but leaf spots developed as abundantly on the uninoculated check plants as on the inoculated ones. Attempts to recover the fungus from any of the spots on inoculated plants gave

negative results. Furthermore, culturing necrotic tissue from leaf spots on both the inoculated and uninoculated plants failed to yield a fungus. In the summer of 1943 and again in 1944 isolations from the margins of young leaf spots were attempted but all gave negative results. A microscopic examination of the necrotic tissue of leaf spots showed no fungus filaments or bacteria present. The evidence thus indicates that the spotting is not caused by a pathogen.

Russet Spot of *Hemerocallis* does not appear to have increased in prevalence during the three seasons of observation. In fact, it was more abundant in 1942 than in any subsequent year, and in 1944 it was of very rare occurrence. This spotting may be associated with some nutritional condition but it does not have the characteristics that nutritional disturbances usually show. At any rate, the evidence presented here does not suggest that this is a contagious leaf spot disease.

MY FAVORITE DAYLILIES

GEORGE GILMER, *Virginia*

I have been growing daylilies for about fifteen years and now have more than one hundred and fifty varieties, most of which have been introduced in the last twenty years. Some twenty-five should be discarded. But it is hard to throw out an old friendly plant, which would be treasured if it were the only daylily in my garden, just because some hard working hybridizer has developed a better one.

This article is about the best of my old and new daylilies. A few are not included because of poor foliage, some fade considerably in the sun, a few increase slowly, a few bloom sparingly, and a few form such dense clumps that the plants are too starved to produce good plants unless frequently divided. The following should please the most critical.

OLD VARIETIES

Gold Dust is the first to bloom. It does well in considerable shade.

Apricot is a little later and larger, cadmium yellow. It is a good and really early bloomer.

Ophir is orange yellow, tall trumpet shape, large and fragrant.

Fulva Maculata is similar to the common roadside lily, but later and much larger. It is very vigorous forming large compact masses with little chance for weeds.

LATE VARIETIES

Chengtu blooms freely in August, coppery orange and carmine. It resists dryness; foliage is almost evergreen. It spreads by underground runners and does not form dense clumps. Distinctly different in matter of growth and foliage. If you like it try also *Hankow*.

August Pioneer is a free bloomer with small flower, chrome orange with reddish flush.

Dorothy McDade is light yellow and perhaps the best of the late varieties.

MIDSEASON YELLOWS

There are more fine midseason yellows than any other class.

Annis Victoria is good, orange, lasting foliage.

Dauntless has wide petals, orange and a touch of pink.

Duchess of Windsor has wide petals, light orange with touch of pink; foliage good until late autumn. None more beautiful.

Lidice, orange with touch of red. Good

Majestic, handsome, large orange.

Mrs. B. F. Bonner, fine light yellow.

Patricia, wide petals, yellow, fragrant. It needs considerable sun to do well.

Princess, large light yellow.

Queen of Gonzeles, orange.

Queen Wilhelmina, orange.

Wau-Bun, early midseason orange with long twisted petals. Fine variety. If you like it try also *Taruga*, similar in pattern but light yellow.

Theodore Mead, fine yellow with interesting shape.

MIDSEASON PINKS

Bertram H. Farr veined, peach pink, beautiful large flower, early midseason.

Corinne Robinson, good light pink, increases freely.

Emberglow, beautiful pink with good foliage lasting into November, increases rapidly.

Helen Wheeler fine pink, but increases slowly.

Sweetbriar, good pink.

Tara, good dark pink, free bloomer.

MIDSEASON REDS

Granada, good red with wide petals.

Indian Chief, large orange red with good foliage until late November.

Matador, tall red near flame, distinctive.

Peony Red, good foliage late in the fall.

Persian Princess, dark red.

Port, small red flowers that hold color in the sun.

Purple Waters, not purple but as near purple as any I have. Lovely flower.

Red Bird, good bright red with lasting foliage.

Russell Wolfe, fine red, but fades some.

San Juan, fine red with wide petals.

Victory Taierhchwang, wine red with lasting foliage.

Vulcan, maroon, has bud shoots on bloom stems that grow to blooming size plants second season if stuck in ground.

War Path, good late red.

Wekiwa, velvety red, good.

MIDSEASON BLENDS

Aladdin is the first daylily to bloom, golden yellow with brown eye.

Mikado, the favorite "eye" daylily, orange with red eye. Plant is below average in vigor.

Caballero, vermillion red and golden yellow.

Carnival, fine red with foliage lasting a month after freezing weather.

Dr. Stout, red and gold, is one of the best.

George Kelso, bicolor, prominent garden effect, increases rapidly.

Mayor Starzynski, orange, red, long blooming season, increases rapidly.

Rajah, orange and red, vigorous, tall, and good.

Victory Montevideo, orange and rusty red, one of the best.

DAYLILY TRIALS IN NORTH CAROLINA¹

ELIZABETH LAWRENCE, *North Carolina*

In March 1944 Dr. Traub sent me twenty-nine of his daylily seedlings to try in my garden in order to see how they thrive in this part of the country. I put them in a row in the cutting garden, and six of them bloomed the first year. Two died, *Helen Wheeler* and *John Blazer*. This year all of the others with the exception of *Elaine* bloomed. They bloomed from the tenth of May to the tenth of July. The blooming dates were a little earlier than those for daylilies bred in the North. This year *Amaryllis*, *Lemona* and *Florham* began to bloom May thirty-first and *Bay State* on June twentieth. *Russel Wolfe*, the latest of Dr. Traub's, began to bloom June tenth. Thus the two groups make a nice long season.

The first of the seedlings to bloom (May 10) was *Victory Montevideo*. This is a very gay red one with well branched floriferous stalks, but it is not outstanding in the group except for its season. It comes at a time in my garden when daylilies, especially reds, are scarce and are much needed. The time when spring flowers are on the wane or faded, and summer flowers have not come.

The spring of 1945 has been a peculiar season as to bloom, but I was interested to see that of the six of these daylilies that bloomed the

¹ The clones under trial are *Peony Red*, *Helen Wheeler*, *Carnival*, *Fire Red*, *Elaine*, *Granada*, *La Tulipe*, *San Juan*, *Mayor Starzynski*, *Victory Montevideo*, *Emberglow*, *Indian Chief*, *Victory Taierhchwang*, *Dr. Stout*, *Lidice*, *Wekiwa*, *Fred Howard*, *Theodore Mead*, *John Blaser*, *Corinne Robinson*, *George Kelso*, *Mildred Orpet*, *Russell Wolfe*, *Queen Wilhelmina*, *Reba Cooper*, *Rouge Vermilion*, *Golden Glow*, *Duchess of Windsor*, and no. 704. The clones not mentioned in this report will be included in future reports.

first year the dates for the second year were not very different. Two bloomed on the same date each year.

Victor Taierhchwang is the best grower and bloomer of the group. There were five stalks this year with thirty or more flowers to a stalk. It began to bloom the first day of June, and bloomed until the end of the month. The stalks were forty-two inches tall. The flowers were dark, a mixture of Brazil and Morocco reds with a bright chrome throat and distinct yellow midribs. They were comparatively small with narrow, fluted and recurved petals. This is one of my favorites for I am very partial to the bright dark colors, and much prefer a mass of color to a few large flowers.

Three others made four stalks—An enormous bicolor (No. 704) three feet tall and not branched, *La Tulipe*, and *Reba Cooper* with not more than fourteen flowers to a stalk. *Reba Cooper* is an ochraceous salmon with a tawny tinge, and a well defined triangular halo (or semi-halo) of dragon's blood red. Last year it bloomed on May fifteenth, and this year on May twenty-first.

Carnival is another of my favorites. There were three branched stalks three feet tall, with as many as twenty-three flowers to a stalk. The flowers were large—the segments four and a half inches long—and bright. As with most of these lovely shimmering daylilies that change in every light and from day to day according to the amount of heat and sunlight, the color cannot be found in Ridgway, nor can it be accurately described. It is somewhere between Nopal red and Pompeian red with a quivering iridescent sheen. This is an outstanding daylily on all counts, size, brilliance and number of blooms.

The *Duchess of Windsor* bloomed on May the ninth in 1944, and on June the third in 1945. I rather suspect that the difference is due not to the erratic season but to the gambols of my Springer pup who loves to plunge through a clump of daylilies when the dew is on them. This is a short stemmed variety (thirty-two inches) with a few large flowers of a pale amber color that is not in Ridgway. The throat is a deeper yellow, and there is a very faint halo. The flowers were large and of a good substance, and I am sure it will prove (puppy willing) a valuable early bloomer.

Golden Glow is a very fine light cadmium self of good form and substance. It began to bloom early in June.

La Tulipe, one of the most floriferous and colorful of the group, is one of the later ones, blooming from June the second to July the eighth, with four well-branched stalks of medium height and up to twenty-eight flowers to a stalk. The large, flaring wide-petaled flowers were near Ridgway's garnet brown and of a sparkling brilliance, with a difference in tone between the outer and inner segments. The throat is yellow and deep green. *La Tulipe*, *Russel Wolfe* and *San Juan* were the three of the seedlings still blooming on July the first. *Russel Wolfe* is the tallest of all, with stalks over four feet, well branched and with large flaring flowers. The segments were $4\frac{1}{2}$ inches long—the inner ones an inch wide and the outer ones narrower. The inner segments are madder brown to Pompeian red, the outer ones dragon's blood red. *San Juan* bloomed

from May thirty-first to July sixth, exactly five weeks. This is one of the handsomest of Dr. Traub's seedlings. It is tall, to 45 inches, with large dark, faintly scented flowers of a most unusual color. Checked against Ridgway they were between garnet and maroon one day, and almost pure ox-blood on another, but you cannot check the purple lights nor the deep bloom of the petals like the bloom on a purple plum. This year *San Juan* had but one stalk and that not much branched. I hope it will bloom better another season, but even as it is, it is one of the best.

Peony Red is to me the most interesting of all because of its rare color. It made a very weak clump with only one stalk, thirty inches tall, and few flowered. The flowers were small but prettily formed. The first opened on the second of June and they lasted well through the month. According to Ridgway the color is somewhere between ox-blood and Vandyke red, but this does not give any idea of the dark, rich violet tone that makes it a distinct color from any daylily that I have ever seen. It is a self with a green and yellow throat, narrow ruffled petals and a slightly darker, barely noticeable halo.

The single stalk of *Lidice* bore more flowers than any other variety of this group—fifty-eight flowers to the one stalk. The flowers were rather small with an evenly spread fulvous dust over the deep chrome petals. I think I am going to like this very much as a garden plant. It began to bloom the twenty-fourth of May, and bloomed until about the end of June.

Theodore Mead is a very large cadmium yellow itself with inner segments four and a half inches long and outer segments shorter and narrow. The characteristic feature is the shape of the flowers. They are more rectangular than square. This one bloomed May the twenty-fourth.

Indian Chief produces a very large flower with segments $5\frac{1}{4}$ inches long. The stalk is forty-two inches tall, and not much branched. The flowers are English red with a semi-halo of a deeper tone, a deep chrome throat and a central ridge of deep chrome on each petal.

DAYLILIES IN THE ADIRONDACKS

STANLEY E. SAXTON, *New York*

Almost thirty years ago my father first broke soil for a little vegetable garden beside the summer cottage he had built on the forested shore of lovely Mount Arab lake in the Adirondacks. This soil was mostly light, dry wood-dust or leaf mold, spongy when wet, powdery when dry. Little would grow in it, excepting an occasional hardy variety of bush bean, summer squash or lettuce. Year by year persistent tillage improved it until, by the time I began to build my own place, father's little garden was beginning to produce fairly well.

Having cleared and walled up a garden plot beside my own cottage, I went through a similar period of soil development to reach a point where I might have a few flowers. It was some time before I could even get Annuals to grow, and so, when I suggested to an elderly friend who had a large garden in New Jersey, that I was going to try perennials,

I was warned that it would be a waste of time since nothing would survive the Mount Arab winters. This warning made my determination even stronger and I began to plant all the old standbys I could obtain.

For some time my losses were discouraging. Roses planted in the spring would bloom the first summer, then dry up and die, or rot over the winter. Iris dwindled away in a couple of years; peonies tried hard but remained weak and spindly. The only plants which flourished were woodland natives such as cypripedium, aquilegias, *Dianthus barbatus* or digitalis.

When we first came to the lake my Father had planted in the front yard a plant of *Hemerocallis flava*. This had prospered and grown into a large clump. I had noticed it in other nearby yards so knew it would grow. One day I saw a large clump of *H. flulva Europa* along the road. I dug a few roots and planted them in a rather poor spot where they took hold and flourished. Enthused by this success, I obtained all the literature I could on the new Hemerocallis hybrids then being introduced by Mr. Betscher and Dr. Stout. Many of these were purchased and, as they were introduced, newer hybrids were added until now I have about a hundred named clones, including the best from Betscher, Stout, Sass, Wheeler, Hayward, Norton, Traub and others, as well as quite a few numbered hybrids which I am testing, and several hundred seedlings.

The reaction of these hemerocallis hybrids to climatic and cultural conditions at Mount Arab has been most variable and extremely interesting. For most of the winter a good covering of snow can be expected and so, although frost injury to the crowns and outright winter killing has occurred, cold injury is not as serious as it might be in more exposed places. The real test seems to be the ability of a clone to build up to flowering, give a good display, replenish itself and increase in the extremely short season. I might say that the average season is from May 15th to September 15th although in a good year frost may hold off until later. About four months of growing may be expected.

The early flowering varieties such as *Dr. Regal*, *Minor*, *Aureole* and *Sovereign*, many of which produce their flowering buds the previous year, seem to grow well and flower regularly. Their bloom period is in June which gives them three months to recover and prepare for the long winter as well as form new buds. I was interested to observe that the Manitoba Hardy Plant Nursery of Dropmore, Canada listed only these early varieties. Mr. F. L. Skinner, the owner, advised me that only these kinds flowered well under his extremely cold conditions and short season.

With the mid-season hybrids, my experience has been that generally those which flower earliest have the best chance of producing a good display and making worthwhile increase. The late bloomers seem unable to recover from the long winter and then grow rapidly enough to produce flowers before the autumn frosts. *Mrs. Wyman* bloomed beautifully the first year from a spring planting. It has come up each year since then but has never again flowered. The same is true of *August Pioneer* and most of the hybrids which have *H. multiflora* in their parentage. The *fulva* varieties seem to be good growers. *Margaret Perry* is almost a weed, small roots taking hold in the poorest spots and increasing rapidly.

I have had flowers on this variety as late as October 12th. *Rosalind* is excellent, increasing at a rapid rate; *Maculata* is outstandingly large and brilliant; *Chengtu* is the weakest grower of the *fulva* types and does not always flower well.

The species, *H. aurantiaca*, and many of its progeny are tender and sometimes winter kill. *George Yeld*, *Sir Michael Foster* and *Cinnabar* are in this class.

Some of the named varieties with the most colorful and beautiful flowers seem just able to keep going, each year sending up one bloom stalk from a single fan of leaves, increasing very slowly or not at all. I find this is true of many of the varieties from the south as well as some of Mr. Sass's hybrids. In the latter case I attribute this to the likelihood that *H. aurantiaca* is in the immediate parentage. This may account for other instances of lack of vigor.

The hybrids from Dr. Stout tend to be better growers than most. For example I have a plant of *Theron* obtained at the same time as a plant of Mr. Wheeler's purple, F-56-4. At the end of two growing seasons *Theron* had seven leaf fans with six flower stalks; F-56-4 had but one leaf fan and one bloom stalk. However, I think its flower is more beautiful than the flower of *Theron*; still the latter seems by far the best grower for my conditions. Similar comparisons could be made in numerous instances. Oddly enough, however, this ability to flower well and increase is not necessarily associated with cold hardiness. The variety *Red Bird* has often been mentioned as lacking in hardiness. With me it has grown rapidly and given excellent increase. I have had *Cabellero* since its introduction. Each alternate year the crown has been destroyed by freezing. In spite of this it has each time recovered and given average increase and good flowering the following season. *Patricia* grows very slowly, and Dr. Stout says he has withdrawn *Charmaine* because it is tender. *B. H. Farr*, the result of a cross between these two, seems perfectly hardy and one of my best growers. This would indicate that selections might be made from the progeny of tender parents which would perform well under adverse conditions. Perhaps some of the plants which are being discarded by southern growers because they do not have the evergreen habit would be ideal under conditions such as mine. On the other hand, northern growers might well send outstandingly beautiful flower types, which grow badly in the north, to Florida or California for tests. It seems obvious that eventually selections will have to be made in each color and type class for individuals adapted to the growing conditions of different sections of the country. The best red or pink for Florida would undoubtedly be a different plant than the best one for Canada.

Another type of plant which should prove valuable in the north is the recurrent bloomer of the warmer sections. This would only flower once each year but its ability to prepare for another blooming in a short period should give it the vigor necessary to overcome the handicap of a short season of growth. I found that my greatest success with delphinium comes from the Pacific strain, which in many gardens blooms two and three times each season. Although I only had one blooming, the

plants seemed able to develop and increase each year. Recurrent blooming hemerocallis should respond in a similar manner it would seem.

As my own seedlings have come into bloom, it has become increasingly evident that my selections will be based on the factors of vigor and growth under Mount Arab conditions. So far I have had no seedlings which flowered in less than three years from planting. At three years most have only one leaf fan; a few have as many as three. These more rapid growers will be observed and used in future hybridization. Plants with more numerous flowers are also desirable and this feature is being sought. Color is not a primary problem since the crossing of modern hybrids reproduces a wide range of colors and types. However, it would seem desirable to cross highly colored types on the early-flowering hybrids to produce a race of brightly colored early bloomers for cold regions. This has been done and the results will be observed with great interest.

It is hoped that after some of the newer hybrids have been more carefully observed some evaluations may be made to help those whose growing problem is similar to that described here.

METHODS OF PACKING DAYLILIES FOR SHIPPING

J. S. COOLEY ¹

Daylily plants are probably much more tolerant of abuse in shipment than most plants but they may be retarded very appreciably in their growth by excessive drying out in shipment. No experimental data are known to have been reported on the shipment of daylily plants or on holding them under shipping conditions when packed in different ways. Some experiments are here reported wherein daylilies were given different packing conditions and held for 10 days to 14 days to simulate shipment under severe conditions.

The experiment consisted of 3 tests. In one the freshly dug plants were left in an open building for 2 weeks; in another they were held part of the time at 90°F. during a 10 day period; in the third they were held continuously at 90° for 10 days with some modifications in the wrapping. The same general conclusions can be drawn from all the tests so the first test is typical of all of them and is here reported.

The following packing procedures were employed: The tops of the plants were cut off to within 5 or 6 inches of the roots. The plants having wrapping treatments were bundled and the roots and tops completely wrapped, the paper being folded over at the ends to prevent loss of moisture where a waterproof paper was used.

Plants of the variety *Dr. Stout* were arranged in 5 comparable lots of 6 plants each. Lot 1 was planted as soon as dug and divided. The

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other 4 lots were given the following treatment: Lot 2, not wrapped: Lot 3, wrapped in 2 sheets of newspaper then cardboard rolled around it and wrapped in heavy kraft paper and tied as for shipment. Lot 4 was wrapped in a waterproof paper such as is used by nurserymen to wrap plants and was then given the cardboard and kraft paper wrap just as lot 3. Lot 5 was wrapped in a thin coating of sphagnum moss which had been wet and the excessive moisture squeezed out, then wrapped in waterproof paper, cardboard, and kraft paper like lot 4. All these lots were held in a well-ventilated non-heated building having temperatures about the same as shade temperatures outdoors. The experiment was started August 15 and concluded on August 29. The average maximum temperature at a nearby weather station for the period was 81.4°F. and the average minimum was 58.9°F., which was cooler than usual for the locality and time of year. The holding test was concluded after 2 weeks, when the following record was made: The plants of lot 1 which had no "shipping" treatment, i.e., were planted immediately, had 3 new leaves, 4 to 8 inches long. In lot 2 which had no wrapping the plants were wilted and flaccid with no new roots or tops starting. The plants in lot 3 were showing slight new root formation but no leaf growth, the roots being flaccid but better than lot 2. In lot 4, where waterproof paper alone was used, the new root growth was greater than in any other lot. Some etiolated leaves were starting and the outer leaves were sloughing off, but there was no evidence of impaired life of the crown. The plants of lot 5, where damp sphagnum and waterproof paper were used, showed more rotting of the outer leaves and slightly more leaf growth but less root growth than lot 4. The roots of lots 4 and 5 were turgid and in good condition to grow. All things considered the plants in lot 4, which were completely wrapped in waterproof paper, were in the best condition to start growth immediately. At the conclusion of the holding test the plants were set out and watered.

The records taken 1 and 2 months after planting showed that the plants that had not been wrapped and those that had been wrapped in newspaper had dried out enough to cause slow starting and poor growth. On the other hand the plants wrapped in waterproof paper had been sufficiently protected from drying out so that they seemed to be in as good condition 1 or 2 months after planting as those planted out immediately. The observations here reported indicate that drying of the crowns impairs rapid starting and growth. The maintenance of the turgor of the roots and especially of the crown seems to be much more important than prevention of the sloughing of the outer leaves. The emphasis, therefore, in wrapping and packing should be placed on the maintenance of good root turgor. The complete wrapping of the whole plant—roots and top—in a waterproof paper without added packing material appears to be an effective and practical method of maintaining good turgor during shipment. By this method there was no evidence of any harmful effect from smothering either when inspected after the "shipping" test or 2 months after planting.

6. HARVESTING, STORAGE AND FORCING

CONCERNING ACCELERATED AND OPTIMUM FLOWERING IN AMARYLLIS

IDA LUYTEN, *Wageningen, The Netherlands*

When we started our experiments with *Amaryllis* (syn. *Hippeastrum*) in 1933 little or nothing was known about the influence of temperatures on the flowering-percentage, the number of flower-stalks (scapes) per bulb, the number of opening flowers per inflorescence and the time of flowering.

For the experiments we used groups of bulbs produced by the vegetative method (*Luyten* 1926, 1935, 1936). These groups consisted of uniform bulbs of the same age which in successive years had been subjected during the resting period to special treatments. Before discussing the experiments, a technique is given for raising large bulbs.

In our country *Amaryllis* culture is always a hothouse-culture. The bulbs are planted either in beds directly on the bench, or in pots. We always raise them in pots. After the resting period they are repotted; at the bottom a potsherd is placed for good drainage. The roots are spared. As potting soil 1/3 part pulverized peat, 1/3 part old decomposed cowdung and 1/3 part garden soil is taken, and for each M³ soil 10 kg. Thomas papslack is added. Two-thirds of the bulb is above the soil of the pot, each bulb is surrounded with old cowdung. After this they are sunk into the bedding of nutritive soil to enable the bulbs, planted in pots, to enlarge their root systems. When pots are sunken, care is taken, that the neck of the bulbs are below the level of the soil, which prevents the settling of mealy bugs between the upper-part of the scales. Five times during the year fertilizer is added—2 kg. superphosphate, 1½ kg. magnesium-potassium sulphate and 1kg. ammonium sulphate for each 10 M². Much air, light and moisture is needed. A few times each day water has to be sprayed between the leaves as soon as the leaves appear. During the winter months the bedding has to be heated from 16° to 20° C. at the level of the bulb, in summer from 21° to 24° C. In our experiments the air temperature in the hothouse varied from 17° to 24° C. in winter; and from 20° to 27° C. in April until August. *Hayward* 1938 draws attention to the fact that the pH of the soil should be between 7 to 7.4; it is not allowed to decrease to 6. Should the circumference of the bulb fall below 20 cm. then there is little chance of flowering. In this case such bulbs need a hot water treatment.

Amaryllis have a long flower forming period—from about February to October (*Blaauw* 1931). Three inflorescences can be formed during this time under favourable conditions—each time after the formation of a fourth leaf the terminal growing point is changed into an inflor-

escence. The lateral growing point which is situated in the axil of the last leaf which completely encircles the stem takes care of the continuation of the axis. This axis starts again with the formation of leaves.

The time during which the bulbs are kept dry is used for temperature treatments. After 1930 no more water was given after August 14th and in the 2nd week of September the bulbs were exposed to a special temperature. The storing of the bulbs has to be considered as a preparation to produce flower-stalks later on at times chosen by us. In 1933 groups of bulbs not only were exposed to 23° C. (as advised by bulbgrowers) but also to 27°, 20° and 17° (37 groups,—843 bulbs). The entire groups of nos. 65 and 67 remained at 23°, the other numbers however were divided between 1, 2 or 3 temperatures, depending on the number of bulbs. It was shown that 23° is not a favorable storing temperature. Nos. 1 and 20 were the only numbers of the 61 groups which reacted rather favorably to 23° C. All the other numbers gave either always a low flowering percentage or the flowering percentage fell off or the flowering percentage fluctuated. The 27° treatment did not give a single flower-stalk. However as soon as the bulbs were stored at 20° and 17° the flowering percentage increased. In 1934/35 the numbers kept at 23°, 20° and 17° were again exposed to the same temperature, the ones kept at 27° were then exposed to 17°. The bulbs stored at 27° in 1933/34 flowered in 1934/35 with a much higher percentage than the bulbs exposed to 17° and 20° after storage at 23°. Probably 27° had a retarding effect on the inflorescences initiated in the bulb (which ought to have flowered in 1934/35) causing these inflorescences to remain stationary; 23° has no retarding effect, on the contrary, it accelerated flowering which shows that this temperature promoted growth. Probably the inflorescences which ought to have flowered in 1934 developed too soon at 23° causing them to dry up. The inflorescences of bulbs stored at 27° apparently checked in their growth don't dry up. They flowered after a favorable storage temperature (20° or 17°) in 1934/35.

Still another group treated at 23° was stored at 15° the next year. After 2 years the flowering percentage is almost the same as that for 20° and 17°. Summarizing *the effect of 17° and 20° on the flowering of the first inflorescence* we can say that no great differences are to be found between these 2 temperatures but that the experiments suggest that although sometimes the flowering percentage at both temperatures is almost equal, in general a higher percentage is found at 17°. After treatment with 20° hardly ever all bulbs flower, but at 17° in several cases 100 per cent flower. Flowering is less at 15° than at 20°.

The shooting of the 2nd flower-stalk is also influenced by the temperature. The 23° temperature very seldom shows a 2nd flower-stalk, but 17° and 20° do it far oftener whereas 17° yields higher figures than 20°.

Very rarely all flowers which are initiated in the inflorescence come to development. In the experiments mentioned above the highest number is 5, sometimes 2, the average is 3 or 4. These figures however do not suggest an influence of a special temperature. The flowering i. e.

the opening of the 1st flower in the nos. 57, 65, 67 and 72 is scattered over the months of January, February, March and April. The months are divided into 4 weeks; the flowers of the last 2 or 3 days of the month are added to those of the 4th week. Neither in this process can we detect a special influence of the storing temperatures: However one gets the impression that after storage at 23° the spreading is wider.

After the causes for good flowering had been determined, experiments followed to advance the flowering date in order to be able to cut flower-stalks at Christmas and New Year. Very little is known concerning the forcing of *Amaryllis*. Postponement of flowering is possible by storing the bulbs at low temperature, which postpones flowering until desired. *Amaryllis* bulbs can be stored at 3.3°—7.2° C. from February until July (Heaton 1934), 4 weeks after they are potted, the bulbs flower abundantly at an average temperature of 27°. However because of this postponement flowering only occurs after the normal flowering-period.

Accelerating is possible either by shortening the time required for a cycle (storage, growth, dying off) which normally takes a year, or by advancing of flowering date within the normal year cycle by special treatment. By the first treatment flowers are obtained earlier and earlier and at last at such an early date—in the middle of the summer—that the stalks have no market because of the large supply of other flowers. Therefore the best method for accelerating flowering is the one which maintains the cycle of a year but which allows flowering to occur in a special period—at the time of the best market for flower-stalks. We tried to obtain this first by taking up part of the time for storage of the bulbs at 20°, 17° or 15° by 23° or 9° or 13°; and second, by planting the bulbs earlier. Experiments show that late planting results in somewhat later flowering at 15° and 17° but also causes suppression of flower-stalks (See also Heaton 1937.). Therefore for accelerating flowering it is desirable to plant the bulbs immediately after the temperature treatment and not to wait until the buds are visible. Soon after planting the inflorescences will appear.

Treatment at 9° or 13° shows no accelerating effect as in the case of tulip, hyacinth and daffodil, in contrast with most of the bulbous plants. Hayward (1935) indicates also that low temperatures (1°, 6° and 7.2° C.) are not apt to advance the blooming date of *Amaryllis*. It so severely affected the bulbs, that they did not bloom at all. However 23° following a treatment of 15° and 17° results in much earlier flowering. This treatment was based on the principle that the inflorescences first have to develop inside the bulb at 15°, 17° and 20° before allowing the higher temperature to accelerate the emergence. Not only the flowering is advanced but the spread is also narrowed. Formerly the bulbs flowered in January, February and March, now flowering occurs in December and the beginning of January. Treatment at 23° for 4 weeks has therefore an accelerating and regulating influence on the appearance of flower-stalks. It also shows that 4½ weeks at 20° preceding 23° suppresses many flower-stalks; 6½ weeks at 20° causes more inflorescences

to appear, but a lengthening of this storage-temperature causes the flowering to occur too late. So 20° is not suitable for early flowering. However $4\frac{1}{2}$ weeks at 15° or $4\frac{1}{2}$ weeks at 17° preceding 23° will cause flowering for most varieties before Christmas and New Year. Under these conditions some varieties produce many second flower-stalks, others fewer. The second flower-stalks appear always a little later than the first.

For early flowering—for Christmas and New Year—the following is advised: after the middle of August no more water is given; about September the bulbs are pulled up. Care is taken that the temperature of 15° or 17° is supplied not later than September 10th; 15° may cause even somewhat earlier flowering. The bulbs are subjected to this temperature for $4\frac{1}{2}$ weeks (until October 13th), then they are subjected to 23° during 4 weeks (until November 10th) and are then planted as soon as possible in beds or in pots in a hot bed the temperature of which at the height of the lower side of the bulb is kept at 20° as much as possible. The hothouse is kept at 17° — 24° C. All or a major part of the bulbs treated in this way will flower before Christmas. Only a few varieties are a little slower and flower after New Year.

If forced flowering is not wanted, for abundant flowering the following treatment of the bulbs is recommended: no more water is to be given after the end of September and the bulbs are then pulled up. In the middle of October the bulbs are stored at 15° , 17° or 20° , and in the middle of January they are planted again in the way mentioned above. In this way flowering will occur in February and March. If flowering is desired a little earlier the bulbs should be exposed to the indicated temperature a few weeks earlier and planted earlier accordingly— 17° yields the largest number of flower-stalks.

Laboratorium voor Plantenphysiologisch Onderzoek

Wageningen, November 1945.

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POSTSCRIPT.—The term “papslack” may not be generally understood in America, and the word “meal” should be substituted for it (on page 156). The abbreviations, “M³” and “M²” (on page 156) signify “cubic meter” and “square meter” respectively.—*Ida Luyten*.

7. THE AMERICAN PLANT LIFE SOCIETY

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REGISTRAR OF DAYLILY NAMES—Prof. J. B. S. Norton, 4922 40th Place,
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[Correspondence about priority of Daylily names should be sent directly to Prof. Norton, but a self-addressed, stamped envelope should be enclosed if a reply is expected.]

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[Reports from official trial gardens, indicated below, should be made directly to Prof. MacDaniels, by Aug. 1 in each year in order to be included in annual summary for HERBERTIA.]

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- | | |
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| Prof. John V. Watkins, in charge of Daylily Trial Garden, College of Agriculture, University of Florida, Gainesville, Fla. | Dr. Raymond C. Allen, in charge of Daylily Trial Garden, Dept. of Agriculture, Cornell University, Ithaca, N. Y. |
| Dr. Paul L. Sandahl, Supt., in charge of Daylily Trial Garden, Dept. of Parks & Public Property, City of Des Moines, Iowa. | Dr. S. H. Yarnell, in charge of Daylily Trial Garden, Division of Horticulture, Texas Agric. Expt. Sta., College Station, Texas. |
| Prof. Ira S. Nelson, in charge of Daylily Trial Garden, Dept. of Horticulture, Southwestern Louisiana Institute Lafayette, La. | Mr. Chas. E. Hammersley, 714 Majestic Building, Milwaukee, Wisc., in charge of Daylily Trial Garden, Milwaukee City and County Parks. |

Note.—Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practical each trial garden will publish, in HERBERTIA, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

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- | | |
|--|--|
| Col. Russell S. Wolfe, <i>South Carolina</i> | Dr. J. C. Du Puis, <i>Florida</i> |
| Mr. R. W. Wheeler, <i>Florida</i> | Mr. Cecil Houdyshel, <i>California</i> |
| Mr. A. C. Buller, <i>South Africa</i> | Mr. George W. Arbukel, <i>New Jersey</i> |
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| Mr. Fred M. Danks, <i>Australia</i> | Mr. Frank Reinelt, <i>California</i> |
| Mr. Guy Wilson, <i>North Ireland</i> | Mr. Lionel Richardson, <i>North Ireland</i> |
| Mr. Kenyon L. Reynolds, <i>California</i> | Mr. E. A. Bowles, <i>England</i> |

ALSTROEMERID COMMITTEE—Mr. H. L. Stinson, *Chairman, Seattle, Wash.*
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Mr. F. Cleveland Morgan, *Quebec*
Mr. Claude A. Barr, *South Dakota*
Prof. A. I. Vvedensky, *U. S. S. R.*
Dr. Henry A. Jones, *Maryland*
Mr. F. L. Skinner, *Manitoba*
Mr. William T. Stearn, *England*
Miss Elizabeth Lawrence, *North Carolina*

4. DATA CARD FOR HEMEROCALLIS

When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and fully described in HERBERTIA, Vol. 7, 1940. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

These cards are available at present in the 3 inch by 5 inch size at the nominal price of \$1.25 per hundred, to pay for printing, handling

and postage. Make checks payable to the AMERICAN PLANT LIFE SOCIETY, and send orders to—

*Mr. E. Frederick Smith, Asst. Sec'y.-Treas.,
The American Plant Life Society,
Box 2398, Stanford University P. O., Calif.*

5. SCORE CARDS FOR HYBRID AMARYLLIS AND HEMEROCALLIS

(a) *Hybrid Amaryllis*. For classification of flower types and score card for Hybrid Amaryllis see HERBERTIA, Volume 5, pages 141 to 145, 1938.

(b) *Hemerocallis Score Card*. For the official score card for Hemerocallis see HERBERTIA, Volume 7, page 126, 1940.

II. PUBLICATIONS OF THE AMERICAN PLANT LIFE SOCIETY

(1) HERBERTIA, THE YEAR BOOK DEVOTED TO THE AMARYLLIDS (AMARYLLIS FAMILY).

A complete file of HERBERTIA, the year book of Amaryllis Section of the American Plant Life Society, is indispensable to all who are interested in Amaryllids. A limited number of copies of the following are still available:—

Volume 1 (1934). DEDICATED TO HENRY NEHRLING. Containing the biography of Henry Nehrling, and many valuable articles on amaryllids; with a portrait of Henry Nehrling and 16 other illustrations; a total of 101 pages.

Volume 2 (1935). DEDICATED TO THEODORE L. MEAD. Containing the autobiography of Theodore L. Mead, and many excellent articles on varieties, breeding, propagation, and culture of amaryllids; with portraits of Theodore L. Mead and David Griffith and 18 other illustrations; a total of 151 pages.

Volume 3 (1936). DEDICATED TO ARTHINGTON WORSLEY. Containing the autobiography of Arlington Worsley, and important articles on description, genetics and breeding, physiology of reproduction, and amaryllid culture; with 3 portraits of Arlington Worsley, one color ture; with 33 plates and 2 figures; a total of 218 pages.

Volume 4 (1937). FIRST BRITISH EDITION. DEDICATED TO WILLIAM HERBERT. Containing the biography of William Herbert; the reprint of Herbert's essay, on Crosses and Hybrid Intermixtures in Vegetables; Dr. Darlington's essay, The Early Hybridizers and the Origins of Genetics, and many important articles on description; cytology, genetics and breeding; physiology of reproduction, and amaryllid culture; with two portraits, forty-four other plates and three figures; a total of 280 pages.

Volume 5 (1938). FIRST NETHERLANDS EDITION. DEDICATED TO ERNST H. KRELAGE. Containing the autobiography of Ernst H. Krelage; the history of amaryllid culture in Holland by Ernst H. Krelage, Dr.

Uphoff's important article in which the name *Hippeastrum* is rejected; a revision of the tribes of the Amaryllidaceae; and the species of Amaryllis; outstanding articles on forcing amaryllids by Dr. Grainger and Prof. Dr. van Slogteren; and many other articles on description, cytology, genetics and breeding; physiology of reproduction, and amaryllid culture; with 33 plates and 2 figures; a total of 218 pages.

Volume 6 (1939). DEDICATED TO THE UNION OF SOUTH AFRICA, and containing articles on South African amaryllids, including the history of botanical exploration for amaryllids in South Africa, the distribution of South African amaryllids in relation to rainfall, and a review of the genus *Agapanthus* by Frances M. Leighton; a review of the Genus *Cyrtanthus*, with many excellent line drawings, by Dr. R. A. Dyer; other articles—*Zephyranthes* of the West Indies by Dr. Hume; the Tribe *Gilliesieae* by Dr. Hutchinson; rating of daylilies for garden value by Mr. Kelso; daffodil articles by Jan de Graaff, and many other items on description, cytology, breeding, propagation, and amaryllid culture; with 44 plates and 10 figures; a total of 258 pages.

Volume 7 (1940). DEDICATED TO LATIN AMERICA, and featuring articles on Latin American amaryllids; biographies of Drs. Philippi and Holmberg; report by Dr. Goodspeed on the amaryllids collected by the Univ. of Calif., Second Andean Expedition; reports on the flowering of the "Blue Amaryllis," *A. procera*; and many other important articles on the description, propagation, breeding, culture, harvesting and storage of amaryllids. Of special interest are the important articles on the description, breeding and culture of daylilies by noted authorities. With 45 illustrations—30 plates and 15 figures—and a total of 242 pages.

Volume 8 (1941). FIRST DAYLILY EDITION. The first extensive symposium on the daylily, containing biographies of George Yeld, Amos Perry, Hans Sass, and Paul Cook, and important articles on daylily evaluation, breeding, propagation and culture. Also important articles on *Narcissus* and other amaryllids. Thirty-eight illustrations—27 plates and 11 figures—and a total of 185 pages.

Volume 9 (1942). FIRST ALSTROEMERID EDITION. Dedicated to Harry L. Stinson, the outstanding authority on this plant group, who contributes a summary of his work on Alstroemerid taxonomy, breeding, propagation and culture. This volume contains the autobiography of Prof. Dr. Abilio Fernandes, the Check-List of Amaryllids by Major Pam, and a review of the species of *Crinum* by Dr. Uphof, and also many important articles on daylilies, *Narcissus*, *Cyrtanthus*, hybrid *Amaryllis*, *Ixiolirion* and other amaryllids. Thirty-five illustrations—17 plates and 18 figures—and a total of 243 pages.

Volume 10 (1943). 10TH ANNIVERSARY EDITION. Dedicated to Elizabeth Lawrence, the outstanding authority on the use of amaryllids in the garden, who contributes a summary of her work in this field. This volume contains the review of *Agapanthus* and *Tulbaghia*, by Dr. Uphof; an article on *Brunsvigia rosea* and hybrids by Mr. Hannibal; a symposium on *Narcissus* breeding by Messrs. Powell, Reinelt, Berry, and Reynolds; a review of amaryllid chromosomes by Dr. Flory; articles on hybrid amaryllis, daylilies, and many other important articles on amaryl-

lids. Forty-one illustrations—12 plates and 29 text figures—and a total of 205 pages.

Volume 11 (1944). FIRST ALLIEAE EDITION. Dedicated to Dr. Henry A. Jones, the eminent American authority on the onion. This is one of the most outstanding issues up to the present for its record making contributions on the systematics of *Allium* by British authorities, and on onion breeding, propagation, and culture by American authorities. It contains Mr. Airy Shaw's translation of Vvedensky's *Alliums* of the Soviet Union; Stearn's essay on the onion in the Old World and other articles; and articles on onion breeding, propagation and culture by Dr. Jones and his colleagues. There are also important contributions on ornamental *Alliums* for North America, and *Allieae* of North America. There are excellent articles on hybrid *Amaryllis*, Daylilies and various other amaryllids. Forty-three illustrations—25 plates and 18 text figures—and a total of 369 pages.

Volume 12 (1945). FIRST EDUCATIONAL EDITION. Dedicated to Supt. R. C. Huey, a pioneer in the use of amaryllids as an educational tool. This volume contains a brief autobiography by Supt. Huey, and an article by him on the use of amaryllids in teaching plant science; the announcement by Mulford B. Foster of the reintroduction of the sweet-scented *Alstroemeria caryophyllaea*, and an article by Harry L. Stinson on the true *Alstroemeria Ligtu*. This issue also contains an article on the origin of *Tapeinanthus humilis* by A. & R. Fernandes; important articles on *Narcissus* breeding; *Leucocoryne* and related genera; articles on various other amaryllids, including valuable contributions on *Hemerocallis* description and appreciation, breeding, culture, and packing daylily plants for shipping. Twenty-four illustrations—15 plates and 10 text figures—a total of 180 pages.

The prices of the above described volumes are based on the available supply:

Volume	1, 1934,	supply exhausted.
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(2) PLANT LIFE, THE PERIODICAL DEVOTED TO
PLANT LIFE IN GENERAL.

Vol. 1, No. 1. Symposium on Narcissus breeding by various authorities.
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Vol. 1, Nos. 2 & 3. FIRST BROMELIACEAE EDITION. Profusely illustrated symposium on the bromels by Dr. Lyman B. Smith, Mulford B. and Racine Foster, David Barry, Jr., and Ladislaus Cutak.
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[ERRATA, continued from page 7.]

CORRIGENDA FOR HERBERTIA, VOL. 11 (1944) 1946

[Messrs. H. K. Airy Shaw and W. T. Stearn have forwarded the following list of corrigenda.]

NOTES ON THE GENUS ALLIUM

Page	Line	For	Read
3	18 up	Stream	Stearn
11	14 up	(locules)	(loculus)
13	1 down	Zwibel	Zwiebel
	2 up	leek	leek
14	9-10 up	agulosum	angulosum
14	7 down	neck	reek
15	8 up	groeste	frösste
18	22 up	from	form
19	16 up	Tourney	Toûrnay
19	6 up	Stephen	Stephan
19	1 up	Dumortire's	Dumortier's
20	9 down	Schoenoprasum	Schoenoprasa
20	11 up	syn. sect. Melamprason	syn.sect. Kaloprasum C. Koch (1849), sect. Melamprason [delete line 8 up and word 'sect.' on line 9 up]
20	7 up	MOLY Endl. (1836)	MOLIUM G.Don ex Koch (1837)
20	5 up	Stemon, Molia	stemon § Molia
20	1 up, footnote	see Dumortier	see Endlicher, Fl,Poson. 147 (1830); Dumortier
21	6 down	(1836)	(1830)
21	14 down	Schoenoprason	Schoenoprasum
21	18 down	Rhynschoprason	Rhynchoprason
21	11 up	G. Don ex Koch	Endlicher
21	10 up	(1837)	(1830)
27	5 down	ovary, var. bulbilliferum	umbel,var.bulbiferum
28	23 down	extraordinarily	extraordinarily
29	22 up	superceded	superseded
30	11 up	and have	have
31	9 up	Schrader Scorodopra-	Schrader, Scorodopra-
32	13 down	or	and

THE FLORISTIC REGIONS OF THE U. S. S. R.

45	10 up	Khive	Khiva
46	1 down	Kela	Kola
46	18 up	1944	1946
46	13 up	Trtysh	Irtysch
46	12 up	Kolyina	Kolyma

<i>Page</i>	<i>Line</i>	<i>For</i>	<i>Read</i>
46	12 up	Tobel	Tobol
46	6 up	Zembla	Zemlya
47	12 down	чык.	Чyk.
47	17 down	Ladoga-	Ladogo-
47	19 down	Volzhsky-	Volzhsko-
47	22 down	Volzhske-	Volshsko
48	12 down	Yack.	Үдек.
48	24 down	-Altai	-Alai
49	10 down	(Persia and Afghanistan)	Persia and Afghanistan.
49	3 up	all by	all, by
52	20 down	<i>Borszczowii</i>	<i>Borszczowi</i>
53	1 down	Dzungara-	Dzungaro-
54	11 up	Pamir-Alai	<i>Pamir-Alai</i>
55	15 down	heavenly <i>shan</i>	heavenly, <i>shan</i>
57	16 down	analyzed	analysed
57	1 up	<i>Coloscordum</i>	<i>Caloscordum</i>
58	15 down	<i>funchiaefolium</i>	<i>funckiifolium</i>
58	16 down	<i>caput-medusae</i>	<i>caput-Medusae</i>
58	21 up	<i>Microdictyon</i>	<i>microdictyon</i>
58	11 up	<i>funchiaefolium</i> Hand.— Mazz.	<i>funckiifolium</i> Hand.-Mazz.
58	6 up	Hand.—Mazz.	Hand.-Mazz.
58	1 up	<i>Caput-Medusae</i>	<i>caput-Medusae</i>
59	1 down	syn.	syn.
59	17 down	Tien-Shan	Tien Shan
59	15 up	<i>Macrosphatha</i>	<i>Macrospatha</i>
59	12 up	the most of	most of the
60	1 down	<i>victoralis</i>	<i>Victorialis</i>
60	2 down	<i>funckiaefolium</i>	<i>funckiifolium</i>
60	3 down	Hand.-Mozz.	Hand.-Mazz.
60	4 down	<i>Caput-Medusae</i>	<i>caput-Medusae</i>
61	8 down	261	260
61	11 up	d	d (terminal)
62	2 down	Horti.	Horti
62	4 down	Kaulbart	Kaulbars
		Oster-	Osten-
62	5 down	list is	list (to be published later) is
63	1 down	Osttuerkische	Osttürkische
63	6 down	Locorum	Locorum

THE GENUS ALLIUM IN THE USSR

65	11 down	entrusted	entrusted
65	11 up	in Russian.	in Russian.—W.T.S.]
65	10 up	Certain	[Certain
66	20 down	<i>seravschanicum</i>	— <i>seravschanicum</i>
66	4 up	<i>sypsodictyum</i>	<i>gypsodictyum</i>
66	2 up	l.c.	loc. cit.

Page	Line	For	Read
67	1 & 2 down	l.c.	loc. cit.
68	7 up	Obschest.	Obshchest.
69	19 down	<i>Ophioscordon</i>	<i>Ophioscorodon</i>
72	4 down	coriaecous	coriaceous
72	10 down	Fliaments	filaments
72	16 up	<i>A. Alexandrae</i>	<i>A. Alexandrae</i>
73	4 up	Turcz.	Turch.
75	3 down	Turcz.	Turch.
76	10 up	Roem.et.Schult.	Roem. et Schult.
79	5 down	Turcz.	Turch.
80	13 down	concial	conical
81	5 up	Vved.	(Regel) Vved.
82	9 down	aëriel	aërial
82	10 down	never ex-	never
82	9 up	<i>Borzczowi</i>	<i>Borszczowi</i>
84	13 up	<i>sphaerocephlon</i>	<i>sphaerocephalon</i>
85	12 up	canpanulate	campanulate
88	3 up	<i>callidictyum</i>	<i>callidictyon</i>
89	20 down	s. 1.)	sensu lato)
89	1 up	s. s.	sensu stricto
93	12 up	Regel	(Regel) Regel
97	8 down	Ovary	Umbel
97	18 down	(M.Bied.)	(M.Bieb.)
98	5 up	<i>microdictyum</i>	<i>microdictyon</i>
98	2 up	Kom., l.c.	Kom., l. c.
99	18 up	<i>microdictyum</i>	<i>microdictyon</i>
99	7 up	<i>dictyum</i>	<i>dictyon</i>
100	1 down	<i>Gen.Pl.</i>	<i>Fl. Poson.</i> (1830) 147, <i>Gen. Pl.</i>
100	2 down	<i>Ophioscordon</i>	<i>Ophioscorodon</i>
100	18 up	RHIZIRDIUM	RHIZIRIDEUM
100	11 up	(Vved.,comb.nov.	Vved. comb. n.
100	9 up	almost	more than
102	9-10 up	range Uzankhmat	range, Uzun Akhmat
106	11 up	Dzung—Tarb.	Dzung.—Tarb.
107	19 down	Ang—Sayan	Ang.—Sayan
109	3 down	Arm.—Krud.	Arm.—Kurd.
110	2-7 up	Tien-Shan	Tien Shan
110	6 up	Kara-Tau	Kara Tau
111	22 down	2.	23.
118	25-26 up	<i>A. Chinense</i> Don	<i>A. chinense</i> G. Don.
118	20 up	<i>A.odorum</i> Linné,	<i>A. odorum</i> Linné,
123	24 down	Dzung—Tarb.	Dzung.—Tarb.
124	20 down	Dzung—Tarb.	Dzung.—Tarb.
125	17 down	<i>Prezewalskii</i>	<i>Przewalskii</i>
132	4 up	Khodzaha	Khodzha
135	13 down	var.e	var. ε
135	16 up	var,d	var. δ

<i>Page</i>	<i>Line</i>	<i>For</i>	<i>Read</i>
136	21 down	var <i>g</i>	var. <i>y</i>
137	13 down	var <i>b</i>	var. β
141	3 down	(<i>c</i> 4mm.)	(<i>c.</i> 4mm.),
143	2 up	Dzung—Kashg.	Dzung.—Kashg.
143	1 up	Oland	Oeland
145	10 up	exserted	exserted
148	14 down	perianth-segments.	perianth-segments, subulate
148	2 up	words “ones and”	words “and distinctly broader than in the outer ones”
149	18 up	(Boissier) Halácsy	(<i>Boissier</i>) <i>Halácsy</i>
149	17 up	<i>Boissier</i>	Boissier
150	15 down	<i>Rhiziridium</i>	<i>Rhizirideum</i>
150	5-6 up	a form is prevalent, transitional	there is present a form transitional
152	17 up	straite	striate
154	11 down	<i>G. Don.</i>	<i>G. Don</i> ,
154	12 down	<i>Sequierianum</i>	<i>Sequierianum</i>
171	22 down	Prokhaladnoye	Prokhladnove
173	4 up	Pam.-Al. Zera	Pam.—Al. (Zera
176	21 down	Alm Ata	Alma Ata
176	21 up	spp. 143-225	spp. 143-175
177	23 down	Kyzl-Kum	Kyzyl Kum
178	2 down	Kyzye Kum	Kyzyl Kum
180	10 down	Kyzyl-Kum	Kyzyl Kum
181	1 down	Endemic	Endemic (recorded, however, by Feinburn in Palest. Journ. Bot. (Jerusalem) III (1943) 16 from Amanus Mts and Iraquian Kurdistan— <i>W.T.S.</i>)
181	25 down	Endemic	Endemic (recorded, however, by Handel—Mazzetti (1914) from Iraq, by Nabelek (1929) from Turkey and by Gombault (1938) from Syria— <i>W.T.S.</i>)
182	12 up	Mén.	Mém.
	8 up	Stev.1.c.	Steven, l. c.
183	21 up	Shinshkin	Shishkin
184	5 down	Fomin.	Fomin
185	7 up	ex Ilyin	<i>ex Ilyin</i>
	2 up	SPHAEROCEPHALUM	<i>sphaerocephalum</i>
	1 up	“SPHAEROCEPHALON	<i>sphaerocephalon</i>
187	3 down	Kislovodsk, Akinfiev	Kislovodsk, <i>Akinfiev</i>
187	16 up	exserted	exserted

<i>Page</i>	<i>Line</i>	<i>For</i>	<i>Read</i>
188	7 down	Grossheim	Grossheim
189	15 up	it with <i>A.ponticum</i>	<i>A. ponticum</i> with it
191	5 up	<i>I distinguished</i>	I have distinguished
192	17 up	ex Grossheim	<i>ex Grossheim</i>
195	between 22 & 23 down		

Insert. Section (8). *MOLIUM* *G. Don*, Mon. (1827) 72—Bulb solitary, devoid of a rhizome, spherical or ovoid. Leaf-sheaths usually subterranean. Leaves always flat. Pedicels without bracteoles. Perianth-segments with a single nerve. Filaments entire or with teeth; teeth short or long, but never exceeding the anther. Seeds angular. [Spp. 177-225.]

195	8 up	-Bickerstein	— <i>Bieberstein</i>
195	6 up	-Bickerstein	—Bieberstein
198	12 up	(<i>Regel</i>) Regel	(<i>Regel</i>) <i>Regel</i>
199	9 down	ARIODES	AROIDES
200	13 up	<i>Schulter</i>	<i>Schultes</i>
202	22 up	Scabrid	scabrid
206	20 up	204. SUWOROWI	204. A. SUWOROWI
206	18 up	sub.A.	sub A.
211	2 up	Report Sp.	Repert. Sp.
212	14 down	(1c.Gartenfl.	(Ic. : G'artenfl.
213	12 down	Abh.Munch. Acad.	Abhandl. Math. Phys. Bay. Akad. München
213	14 down	(1c. Bot. Mag.	(Ic. : Bot. Mag.
214	15 down	Lipsky can	Lipsky [restored to specific rank by Vvedensky in Schreder, Fl. Uzbek. I (1941) 465—W.T.S.] can
215	13 up	Tamerlanova's gate	Tamerlane Gate
215	2 up	Afgahanistan	Afghanistan
216	7 up	Section 8. Caloscordum	Section 9. CALOSCORDUM
217	16 down	Section 9.	Section 10.

KEY TO THE ALLIUMS OF EUROPE

219	10 down	Willkomm.	Willkomm,
219	16 down	Couthino	Coutinho
219	13 up	<i>victoralis</i>	<i>Victorialis</i>
219	4 up	(3.3mm)	[3.3 mm.]
219	2 up	(i.e.coiled)	[i. e. coiled]
220	4 down	Tenéo	Tineo
220	6 down	(i.e. entirely white)	[i. e. entirely white]
220	9 down	(white)	[white]
220	16 down	(i.e.not mounted on a rhizome)	[i. e. not mounted on a rhi- zome]
221	23 down	<i>Cyr.</i>	<i>Cyr.</i>

<i>Page</i>	<i>Line</i>	<i>For</i>	<i>Read</i>
221	26 down	Cluss.	Guss.
221	15 up	(i.e. round in section)	[i. e. round in section]
221	3 up	Griesb.	Griseb.
222	2 down	Heuff)	Heuff.)
222	14 up	Griesb.et Schlenk.)	Griseb. et Schenk)
	10 up	(i.e. tailed)	[i. e. tailed]
222	9 up	(loose	[i. e. loose
222	8 up	tions)	tions]
222	7 up	(Stamens	stamens
223	4 down	“variegated	variegated
223	4 down	yellow and hoary	yellow, pruinose and waxy
223	9 down	Panc.	Panč.
223	19 down	Boiss.	Boiss.
223	12 up	Panc	Panč.
223	12 up	Panc.	Panč.
223	5 up	(i.e. without bulbils)	[i. e. without bulbils]
224	14 down	acuteolate- scabrid	aculeolate—scabrid
224	19 down	<i>margariaceum</i>	<i>margaritaceum</i>
224	17 up	Vary.	Vayr.
225	4 up	Couthino	Coutinho
225	4 up	Briqurt	Briquet
225	2 up	Halacsy (1940)	Halácsy (1904)

NOMENCLATURE AND SYNONYMY OF ALLIUM ODORUM

227	11 down	F.l.	<i>Fl.</i>
228	3 up	the Dutch East Indies and India;	and the Dutch East Indies;
229	8 down	<i>fareto</i>	<i>farcto</i>
230	1-2 down	Siberia Uralensi	Sibiria uralensi
232	2 down	(-A.	(=A.
233	4 up	<i>cepa</i>	<i>Cepa</i>
235	1 down	<i>Herbarium Botaniska</i>	<i>Herbarium, Botaniska</i>
237	15 down	albus scapus	albus. Scapus
237	17 up	<i>Mon. 33</i>	<i>Mon. 133</i>
237	15 up	<i>nerinifolium</i>	<i>neriniflorum</i>
238	4 down	redicalia	radicalia
238	6 down	violaceaus: Umbella	violaceus: <i>umbella</i>
238	24 down	(1853)	(1852)
238	20 down	Siberia	Sibiria
238	18 up	Redoute	Redouté
238	17 up	Kew-Gawler	Ker—Gawler
238	11-13 up		

REMOVE Butomissa * * * (1895) and transfer to between lines 8 and 9 up.

238	7 up	Redoute	Redouté
238	7 up	<i>tuberosum</i>) Mongolia	<i>tuberosum</i>) ; Mongolia
239	15 down	<i>nerinifolium</i>	<i>neriniflorum</i>

Page	Line	For	Read
239	19 down	33	133
239	21 down	Mikino	Makino
239	13 up	Amoer.	Amoen.
240	3 down	<i>A. sinicum Noronha</i>	<i>A. sinicum Noronha</i>
	5 down	<i>A.tuberosum Roxburgh</i>	<i>A. tuberosum Roxburgh</i>
	14 up	Teresaki	Terasaki

PAGE 241

DELETE lines 3-7 and SUBSTITUTE:—
Type-locality:—"Kiang Sou (d'Argy)" (H. Léveillé).
? *A.jaluanum* Nakai in Bot. Mag. Tokyo 27. 214 (1913).
Type-locality:—"Corea sept.: Flum. Jalu" (T. Nakai).
A. yesoense Nakai in Bot. Mag. Tokyo 36. 117 (1922) fide
Nemoto, Nippon Shokubutso Soran Hoi 1051 (1936).
Type-locality:—"Yeso: in araneis Zenibako, prov. Ishikari"
(T. Nakai).

241	12 down	Teresaki	Terasaki
241	20 down	India (Assam) and Nepal; it is cultivated	India (Kashmir, Nepal, Assam) ; it is or has been cultivated
241	15 up	fibrous-tuniced	fibrous-tunicked
241	11-12	inter alia	<i>inter alia</i>
241	11 up	bulb-tunics linear	bulb-tunics, linear
241	6 up	<i>Rendle</i>	Rendle
241	5 up	Lévéillés'	Léveillé's
241	3 up	<i>jalvanum</i>	<i>J'aluanum</i>
242	15 down	311 (1938)	311 (1838)
242	15 down	<i>Janka</i>	Janka
242	16 down	Petrop	Petrop.
242	17 down	<i>tataricum typicum</i>	<i>tataricum a typicum</i>
242	23 up	Schulties	Schultes
242	11 up	-Sea	—See
242	2 up	Gorenk :	Gorenki
243	4 down	Lipcky	Lipsky
243	5 down	Turkestanaka	"Turkestanskaya
	6 down	Antropol; Etongraf.,	Antropol. i Etonograf
243	13 down	Povov	Popov
244	4 up	Tobel	Tobol
245	1 down	<i>Vved.</i>	Vved.
245	6 down	broad.channelled.	broad, channelled.

On page 243 the Key-contrast 4B (line 7 up) should be aligned with 4A (on line 12 up) and all subsequent lines correspondingly indented to line 19 down on p. 244.

On p. 244 the Key-contrast 10B (line 2 up) should be aligned with 10A (line 12 up) and all subsequent lines correspondingly indented down to end of Key.

On p. 245 the Key-contrast 13B (line 9 down) should be aligned with 13A (line 4 down) and all subsequent lines correspondingly indented down to end of Key.

AMARYLLID GENERA AND SPECIES

In this department the descriptions of amaryllid genera and species translated from foreign languages will be published from time to time so that these will be available to American and British readers.

Allium Cepa L., clon *perutile*, Stearn, cultivar, Gard. Chron. Sept. 4, 1943, pp. 86-88.

Plants perennial, caespitose, glabrous, evergreen, edible, rarely flowering; bulbs clustered, narrow, ovate-oblong, 1.5-2.5 cm. thick, the outer scales thin, brown, the subexterior ones mostly red; leaves suberect, distichous, mostly 5 or 6, linear, hollow, semi-cylindric, upwardly lightly channelled, rounded below, glaucous, up to 40 cm. long and 9 mm. broad, 5 mm. thick; flowering stem fistulose-inflated in the lower part, exceeding the leaves, 40-55 cm. long, up to 1.5 cm. thick; umbels many-flowered, subhemispheric, 2.5-3.5 cm. broad, the green pedicels up to 2 cm. long; expanded flower 8-10 mm. in diameter; perianth segments white with a green dorsal line, acutish, about 4 mm. long, scarcely 2 mm. broad, the outer narrowly ovate, the inner narrowly ovate-oblong; stamens exserted; filaments white, about 5 mm. long, the outer simply subulate, the inner broadly expanded at base; anthers greenish-yellow; ovary depressed globose, white; style white, up to 4 mm. long. Cultivated in English gardens for culinary uses. Type in the Kew Herbarium.

[ALLIUMS — INDIA, continued from page 84.]

lar, the inner with the base broadly auricled, sometimes shortly dentate on each side; anthers ellipsoid, about 1 mm. long. Ovary subglobose, with 2 ovules in each chamber; style included, scarcely 3 mm. long.

Near *A. sikkimense* Baker but distinguished by the smaller, less campanulate flowers, with the alternate stamens broad-shouldered and often toothed.

Hab.; Tibet; Karo La Pass, about 16,500 ft. (Walton, July 1904); near Maku La (Younghusband, July-Aug., 1903 no. 178); Kara La, 15 miles from Lhasa (Dungboo, Aug. 13, 1878).

8. THE BUYER'S GUIDE

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- No. 6. Very robust flower, solid crimson, slightly greenish white center.
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- No. 8. Robust flower, velvety red (exquisite).
- No. 9. Robust flower, petals solid red, sprinkled or freckled with white dots, submerged whitish stripes.
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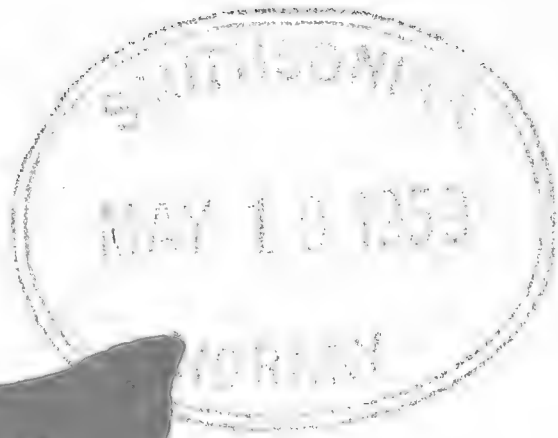
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HERBERTIA

VOLUME 13

NARCISSUS EDITION

EDITED BY
HAMILTON P. TRAUB

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

1946

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PREFACE

This NARCISSUS EDITION of HERBERTIA is appropriately dedicated to Guy L. Wilson, the eminent British *Narcissus* breeder, who received the 1946 HERBERT MEDAL for his achievements in his specialty. In the field of plant improvement there has existed for a long time a "One World" concept, and we in America are always gratified by genuine achievement in any part of the World. Mr. Wilson has favored us with an interesting autobiographical note, and a valuable article on *Narcissus* breeding.

The cover design featuring trumpet *Narcissus* is the work of our talented friend, J. Marion Shull.

Our friends, Dr. Abilio Fernandes and Mrs. Fernandes, of the University of Coimbra, Portugal, again favor us with an outstanding contribution; this time on a subject particularly appropriate for the NARCISSUS EDITION—"On the Karyo-Systematics of the subgenus *Ajax* of the genus *Narcissus*." This provides basic information of great value to all *Narcissus* breeders. We are again greatly indebted to Dr. Thomas W. Whitaker of an excellent translation into English from the original French.

We are also greatly indebted to the NARCISSUS COMMITTEE, and particularly to its energetic and able Chairman, Mr. Arno H. Bowers, for arranging for the valuable contributions on *Narcissus*, including in addition to the above, other excellent articles: Harold Alston writes on the daffodil in Australia; Mr. Bowers on the parents of hybrid *Narcissus*; Messrs. Reinelt, Powell, Culpepper, Ballard and Cooley on *Narcissus* breeding; Charles J. Gould contributes an article on *Narcissus* diseases, and E. P. Breakey, on the insect and mite pests of *Narcissus*; Mr. Hayward, Dr. Cooley, Miss Kell and Prof. Watkins write on *Narcissus* culture.

In connection with the NARCISSUS EDITION, the reader should also consider the article in HERBERTIA 1947 on the breeding of double *Narcissus* by "Ornatus," an article that is beautifully illustrated from photographs furnished by Mr. Jan de Graaff.

Important articles on the other amaryllids are also included in this issue: Mr. Claar contributes two articles on *Hemerocallis*; Mr. Saxton writes on the Wheeler daylilies; Mrs. Bright Taylor, and Mr. George Gilmer write on daylily culture, and many new daylily clones are described under registration of new clones; Mr. O. Mohr writes an historical note on *Amaryllis* culture in Denmark, 1940—1945; Mr. Hayward contributes an article on *Amaryllis* culture in Florida; Dr. Uphof gives a review of the genus *Habranthus*; Mrs. MacArthur writes on *Habranthus brachyandrus*. There are also articles by Prof. Watkins on the culture of crinums; Miss Lawrence on *Hymenocallis*; Mr. Hunt on *Lapagerias* and *Agapanthus*, and Jo N. Evans on various amaryllids.

The next issue of HERBERTIA will be the 2ND DAYLILY EDITION. It will feature the daylilies, but will also contain the usual articles on the other amaryllids.

Beltsville, Maryland,
September 2, 1947.

Hamilton P. Traub.

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves, scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

CORRIGENDA

HERBERTIA, VOL. 12 (1945) 1947

Page 18, 3rd line from bottom, for “1946” read “1945.”

Page 20, 7th line from bottom, for “her” read “him.”

Page 25, 4th line from bottom, after “(Allium Tribe)” add “; and GILLIESIAE (Gilliesia Tribe).”

Page 33, 16th line from top, for “*Marocco Red*” read “*Morocco Red.*”

Page 40, 2nd line from bottom, for “to cm.” read “to 47 cm.”

Page 41, last paragraph, 5th line, for “6-inch” read “8-inch.”

Page 69, 3rd line from top, for “Kewennsis” read “Kewensis.”

Page 69, 19th line from top, insert quotation mark before “The flowers” etc.

Page 83, species 29, first and 2nd lines, for “A. GATENAUM” read “A. *Gageanum.*”

Page 112, 7th line of text, from top, for “stories” read “stores.”

Page 123, 11th line from bottom, for “speedy” read “speed.”

Page 151, 23rd line from top, for “itself” read “self.”

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Dedicated to
GUY L. WILSON



Herbert Medalist—Guy L. Wilson

GUY L. WILSON

An autobiographical note

I was born in a pleasant home within a mile of where I still live in the green countryside of County Antrim, Northern Ireland. I was much the youngest of a considerable family, none of whom were particularly interested in horticulture, so I always say that the love of Daffodils must have come into the world with me from some better place, as I cannot remember a time from my earliest childhood when I did not love them ardently. An old family retainer now in the eighty-sixth year of her age can tell me how, when as a child, I was in her charge on Sundays while the rest of the family went to Church, she had only to turn me out on the lawn on spring days where I spent the whole forenoon turning up the heads of the Daffodils one by one to gaze at them. I still have most vivid recollection of my delight in day by day watching the developing buds and opening flowers of a little colony of the dear old double yellow Daffodil that grew in the grass on the lawn on the sunny side of a clump of laurels: then came a morning when I ran out to see the beloved flowers, and found to my horrified anguish that they had almost all disappeared; I rushed back to the house in quite inconsolable tears, to find that a maid had been given permission to pick a bunch to take home on her day out.

My Mother greatly loved flowers but grew them on a limited scale, as the cares of managing a household did not leave her much time for gardening. We had a large walled garden which was almost entirely devoted to the cultivation of vegetables and fruit, and our old gardener had little time to help with the flowers. My Mother was also handicapped by a quite unjustified idea that only the very hardiest and commonest things could hope to thrive in our rather bleak wet and late climate.

In those days little attention had been given to Daffodils in Northern Ireland and the very few that were known to me were those that grew around my old home. We had the old double *Telamonius Plenus* or *Van Sion* and the English Lent Lily and *Nanus*, which we called respectively common double, common single and the dwarf Daffodil, growing in the grass. In the garden borders there were a few tufts of *Obvallaris*, the Tenby Daffodil, and large clumps of Double Incomparabilis *Golden Rose* which I think had come to us from some cottage garden under the name Rose of Sharon! Anyhow we called it the Rosy Daffodil: we also had *Poeticus Recurvus* in the grass, and the lovely sweet scented double white Gardenia flowered *Poeticus* blooming profusely in the garden; but in those days these to me were "single and double Narcissus," something a little different from Daffodils, but very close to them in my affections: I used to say that my favourite flowers were Daffodils and Narcissus.

I have a clear recollection of one day in my very early childhood asking my Mother, "Are there any white Daffodils?" to which she replied, "Yes, I think there are, though I have never seen them, and if you take great care of it I will let you look at a book with pictures of some;" whereupon she showed me the 1888 issue of William Baylor Hartland's "Original Little Book of Daffodils." I still regard that lovely old Catalogue as one of my greatest treasures. I can vividly remember my childish delight and excitement at the idea that white Daffodils really existed, and at seeing pictures not only of them but of other hitherto undreamed of beauties with white petals and yellow trumpets, such as *Empress*, *Horsfieldi*, *Grandis*, etc., as well as such things as *Emperor* and *Sir Watkin*. Many an hour I subsequently spent studying that old Catalogue and I probably owe much to its inspiration; at all events I think it is ever since that time that I have had a special love for white Daffodils.

My Mother used to order just a few bulbs from Hartland year by year; how I used to watch for the arrival of those parcels, and how the very sight and handling of bulbs thrilled me. At a very early age, perhaps six or seven, I wrote to Hartland and asked him for a photograph of himself! He sent the photograph, which alas I have lost, with a most charming letter, and this was followed in autumn by a very nice little collection of Daffodils of some twelve or more varieties which he sent as a gift. From then onward of course all my pocket money was saved up to spend on bulbs, and various kind friends gave me bulbs from time to time, so that by the time I had to leave home to go to boarding school I had quite a thriving little collection. In the early months of the year I used to write home to my Mother, eagerly enquiring how this or that particular bulb was progressing; sometimes I sent her plans of the beds, marking the exact spot where special things were growing. It was fortunate that Easter holidays coincided with the Daffodil flowering season.

One of the most outstanding memories of my early youth was when on leaving school I went with my parents for a trip to Southern Ireland at Easter time, and we called at Cork to see Mr. Hartland and his Daffodils. Hartland was a great enthusiast and was the pioneer of Daffodil growing in Ireland. He was contemporary with Peter Barr, the founder of the well known firm of Barr & Sons in London; the Daffodil owes much to these two men. What I remember most clearly of that day's visit was a big stock of Bicolor *Horsfieldi* in magnificent condition, and a glorious display of *Hispanicus Maximus*, or as Hartland called it in those days, *Maximus Superbus Longivirens*; and how I surprised Hartland by picking out a plant of *M. J. Berkeley* from amongst this *Maximus*. That incident makes me think that *M. J. Berkeley* is probably a sport from *Hispanicus Maximus*, as Hartland told us that that particular lot of *Maximus* had recently been imported from Spain. On that day also I had my first sight of *King Alfred*, of which Mr. Hartland showed us twelve plants with much pride, remarking that they were worth £60. It was of course the finest trumpet

Daffodil I had seen up to that time. I remember feeling much gratified on coming home from this trip to find that my own Daffodils, though much later than Hartland's, grew with at least equal vigour and strength, so that our County Antrim climate could not have been so bad as my Mother seemed to think.

Of course I always wished to make bulb growing or Daffodil growing my profession and often said so, but my Father could not believe that it was possible to make a living from growing Daffodils, and always rather discouraged the project, while my sister and brothers were somewhat bored by what they considered my Daffodil madness, and the Daffodils were sometimes referred to as "the Yellow Peril." So when on leaving school I was offered a small post in my cousin's Woollen Factory which was near my home I was glad to accept it, as it enabled me to live at my old home, which I loved, and go on collecting and growing Daffodils.

During all this time I had not realised the possibilities of cross fertilising Daffodils and raising new varieties from seed; but I took one of the English gardening papers, then known as "The Garden," and occasionally saw in it what were to me most exciting accounts of the Rev. G. H. Engleheart's new seedlings which were appearing at the Royal Horticultural Society's spring Shows, and at the Midland Daffodil Society's Shows.

When I was twenty-one years of age I went to England to visit Mr. A. R. Goodwin, a keen amateur Daffodil lover who then lived at Kidderminster, and accompanied him to the Midland Daffodil Society's Show at Birmingham, helping him with his exhibits. In those days the Midland Show was the Mecca of Daffodil lovers. There I met Engleheart, P. D. Williams, Ernest Crossfield, Henry Backhouse, Mrs. R. O. Backhouse and others as well as some Dutch growers. The seedlings shown by these raisers were a revelation to me: it was a great occasion and an enormous stimulus to my enthusiasm. I began hybridising at once: that was forty years ago, and I have been at it ever since and hope to continue as long as I live, if conditions in this increasingly uncertain world permit. In due course I began to exhibit myself, and was delighted to find that my Irish grown flowers from the outset more than held their own against those grown in England. Presently there began a friendship between that great breeder, and great gentleman, the Brodie of Brodie, and myself, and for more than twenty years until the time of his death I visited him in Daffodil time every season: what I owe to his generous help and friendship is beyond calculation.

People seeing my flowers at Shows soon began to enquire for bulbs, which I was very glad to sell at first in a small way so that I could afford to buy the better novelties for breeding and exhibiting. Gradually demand increased so that I found it necessary to print a small Catalogue; and in time I realised that in order to give my Daffodils and the business of distributing the bulbs the attention they demanded I should have to give up my job at the Woollen Factory, and did so: and so for a good many years Daffodils have been my life work, as indeed they should

have been from the outset. I need hardly add that they have been an unending source of intense interest and delight, and have also been the means of my forming many delightful friendships and links with people far and near. As I have many correspondents in New Zealand, including one or two friends who had been to see me here, I determined to go out in 1929 for their Daffodil season. This was possible, as my business was then quite small, and of course their flowering season is in August, September and October, so that I could go for that time of year and not miss the flowering season here. That trip will be a most delightful memory as long as I live. Nothing could exceed the wonderful kindness and hospitality which I experienced throughout the whole country. The New Zealanders are very keen gardeners and they are much favoured in their climate and certainly grow fine Daffodils. The country is beautiful beyond description, and not the least enjoyable part of my trip was seeing as much as I could of it, and this was made easy for me by many kind hosts who took me around in their cars.

Turning to my work in Daffodil breeding, a good many of my flowers have by this time got scattered abroad in the world, and it gives me a lot of pleasure to hear that some of them are giving a good account of themselves overseas as well as at home. One of the first of my own raising was the B4 *Mystic*, which was introduced in 1923 and gained an Award of Merit later. *Principal*, a very good all purpose Yellow Trumpet which gained a First Class Certificate in 1937, was first sent out in 1931. *Garron*, a giant Yellow Trumpet of great vigour and fine quality came out in 1924 and subsequently gained an Award of Merit. I had the honour of introducing Engleheart's magnificent White Trumpet *Beersheba* in 1923. It gained a First Class Certificate in 1926. Fine White Trumpets of my own raising are *Cantatrice* (Plate 285), which was introduced in 1936 and awarded a First Class Certificate in 1939; and *Samite* (Plate 286), introduced in 1930 and awarded an F. C. C. in 1940. *Kanchenjunga* (Plate 287), introduced in 1934, gaining an Award of Merit in 1940; and the giant *Broughshane* (Plate 288) which I introduced in 1938 and which gained an Award of Merit in 1943. In the Incomparabilis Division my brilliant yellow and red *Indian Summer* was introduced about 1940 and gained an Award of Merit in 1946. In the Barrii Division the very fine yellow and red *Chungking* and the red and white *Bravura* (Plate 289) are recent introductions which are first class exhibition flowers. Amongst Large Crowned Leedsii *Carnlough*, introduced in 1934, has had remarkable success in Australia and New Zealand where it has won many championships at Shows, while *Slemish*, introduced in 1930, was the leading flower for some years, gaining an Award of Merit in 1935 and F. C. C. in 1939. *Truth*, another very good pure white 4A came out in 1936 and got its Award of Merit in 1940. Amongst Small Crowned 4B Leedsii are several of the best things I have raised, notably *Cushendall*, which was sent out in 1931 and gained an Award of Merit in 1935, and *Chinese White* (Plate 290), first show in 1937 as a seedling flower. It gained an Award of Merit in 1946 and is perhaps the finest 4B seen up to date.

NOTES ON DAFFODIL BREEDING

GUY L. WILSON, *Northern Ireland*

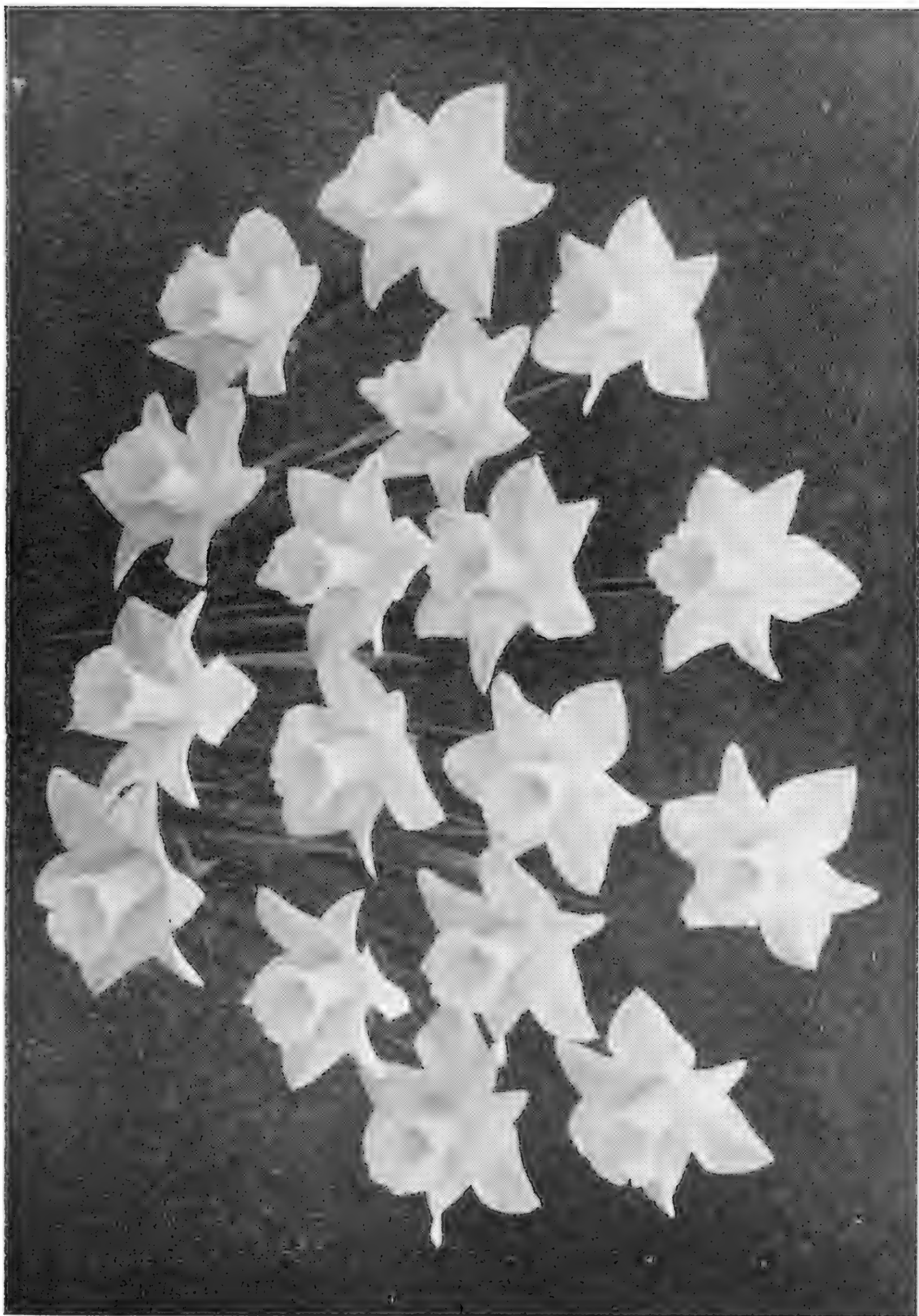
I do not propose to occupy much space in explaining the actual technique of cross fertilisation and seedling raising, as doubtless most readers are familiar with this. Moreover, Professor Sydney B. Mitchell has given some very helpful advice on the cross fertilisation of the flowers and sowing and raising of the seed in the concluding paragraph of his most interesting article on Daffodil breeding for Amateurs in the issue of *Plant Life* for April 1945.

I was much interested to note some slight variations in Professor Mitchell's methods from my own, no doubt partly due to our very different climates: e.g., here I find it best to sow seed immediately it is ripe, before we begin bulb lifting operations; as if kept for a length of time the percentage of germination may be lower or some of the seeds may lie dormant for a season before starting to grow. Also I find it better to sow in fairly deep boxes rather than in beds in the open, as if sown in the open the alternating wet and frosts of our winters would throw most of the seedlings out of the ground, whereas boxes can be given the protection of a cold frame for the first two winters, closing the lights only in frosty weather. At two years old we transplant the seedlings in June, without drying off, straight from the boxes to the beds in which they are to remain till they flower. As the dormant season of Narcissus bulbs is very short or nearly non-existent in our cool wet summers, this permits the little bulbs to start new root growth as soon as they feel inclined. I note that Professor Mitchell does his pollenising by using tweezers, with which I take it he picks up the anthers of the pollen parent and touches the stigma of the intended seed parent with it: I have heard of this method, but my own practice, and that of most British raisers, is to use small sable brushes such as are used by water colour artists, for transferring the pollen. It is of course very important to mark your fertilised flowers carefully, and label the resulting seed carefully and clearly by means of numbers when sowing so that a clear and accurate record of parentage can be kept. It is also wise to think out carefully at least some of the crosses you intend to make before the rush of the flowering season is upon you.

A quite bewildering number of new and fine Daffodils have been raised in the past thirty years, and they continue to be produced in increasing quantity. In spite of the world war an astonishing number have appeared since the British Royal Horticultural Society's Daffodil Conference in 1935. Of course the majority of these new things that appear at Shows never get into general garden cultivation; many because they lack stamina and all round good habit of growth (which includes the capacity to produce a sound firm healthy bulb) necessary to stand up to mass field cultivation and commercial handling. Many of course disappear because they are not sufficiently outstanding and distinct or striking.

In view of this ever increasing flood of new varieties, it is high time that breeders gave more concentrated attention to the production of varieties of really sound and reliable constitution combined with good habit and high quality flowers. Mr. Davis, the late Mr. Engleheart's life long foreman, visited our main London Daffodil Show last April, and is reported to have commented, and perhaps not without reason, that we are sacrificing quality to mere size. One of my U. S. A. correspondents said in a letter received a few weeks ago—"I am becoming annoyed by the great influx of what I call elephants without refinement." One does see some very large and gaudily coloured flowers which have only achieved coarseness. We must be very careful not to lose the beauty and dignity of form natural to the Daffodil. We shall lose all its peculiar charm if we try to make it look like something quite different from a Daffodil: we must make beautiful form, which implies perfect balance and proportion combined with good carriage and habit one of the essential objectives: with this we must also have good substance combined with high quality texture and clear clean colouring. We also want stems of adequate length and strong enough to stand up to weather out-of-doors without support, and if the stems carry the flowers above the foliage so much the better—this is a particularly desirable feature when bulbs are grown in pots for indoor decoration. Incidentally, the first objective of Dutch growers appears to be to obtain varieties that will force easily and early. Definite effort might also be directed towards obtaining sunproof colour in red cupped varieties, as many of these burn badly and get spoilt when exposed to strong sun. Non-fading red cups are attainable, as they come from time to time amongst seedlings and there are already a few varieties such as *Rustom Pasha* and *Flamenco* which are practically sunproof, while J. L. Richardson, I believe has some others amongst his newer red cups. Another desirable objective would be the production of varieties that form good clear firm bulbs. P. D. Williams used to pay a good deal of attention to bulbs, and considered *Fortune* as an example of a variety which makes a bulb of first class type. There are certainly wide differences in the bulbs of different varieties, some being soft or scaly and rough, therefore more likely to harbour such pests as bulb scale mites, etc. and become diseased. I think that *Maximus* blood in a breeding strain helps towards a firm type of bulb.

Daffodil breeding is now carried on by an increasing number of people both trade and amateur in many parts of the world. I know at least one keen amateur in Cape Colony, South Africa: New Zealand is full of ardent Daffodil lovers and raisers from end to end; there are also quite a number in South Australia where many good flowers are being raised; while Tasmania likewise has its quota of extremely enthusiastic breeders and exhibitors who are raising first class things, particularly noteworthy amongst them being Mr. C. E. Radcliff of Hobart, who I believe has made more progress than anyone else in the world in the production of pink crowned varieties. In U. S. A. the cult of the Daffodil is very definitely on the increase: I know of successful breeders in both



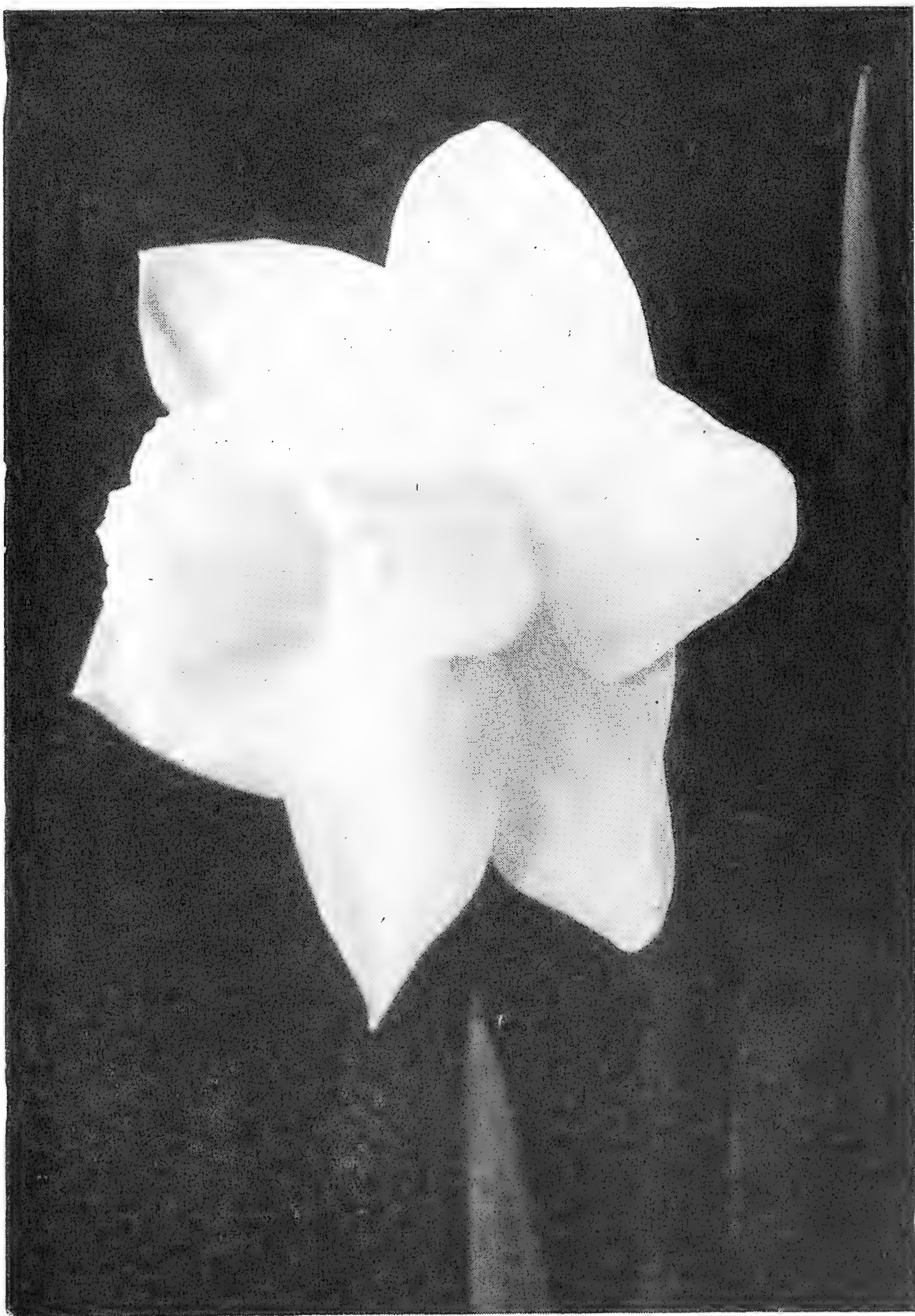
Hybrid *Narcissus*—*Cantatrice* (*Esmiko* X *Beersheba*)

A very smooth large white trumpet of beautiful form; the flower is very graceful, polished; the trumpet is slender, deserving both the Award of Merit and First Class Certificate given it by the R. H. S.
Plate 285

eastern and western States, particularly in Oregon which contains the great Oregon Bulb Farms at Sandy, and Mr. Grant E. Mitsch's farm at Canby—at both of which places the raising of seedlings is extensively carried on; whilst I regard that most brilliant plant breeder, Frank Reinelt of Capitola, California, as likely very soon to become the leading raiser of Daffodils in U. S. A. if indeed he has not already attained that position. If his progress with the Daffodil is as rapid and spectacular as are his glorious achievements in Delphiniums, Begonias and other subjects he may very soon leave us all behind. California has other keen raisers, and there are others still in B. C., Canada. All this is to be warmly commended as varieties raised in each different country are more likely to thrive and do well there than bulbs imported from distant and widely differing climates. It is found, for example, that bulbs sent from Britain to Australia and New Zealand usually take about five years before they settle down and give really good and representative flowers, whilst a few never do really well: it is equally difficult, if not more so to acclimatise bulbs here that have come from there. I understand that many of our British raised things seem difficult to settle in California, frequently lacking vigour and developing Virus there; Although they seem to grow magnificently in the cooler and moister climate of Oregon; but in all these places most if not all survive long enough to provide pollen and seed for producing a home raised race from which plenty can be selected which will thrive and flourish; and breeders will be well advised to work on those strains that they find best adapted to their own conditions of soil and climate.

Breeders of long experience in this country have of course discovered a few varieties that are outstandingly good parents. Time has also taught them to look out for the beneficial influence of certain now relatively remote ancestors in the pedigrees of their seedlings. For example, the good influence of that most beautiful of wild golden trumpets, *Narcissus hispanicus maximus* in transmitting clear colouring, fine durable texture and length and strength of stem; or of Incomparabilis *Princess Mary* in transmitting smoothness and symmetry of form and good habit and carriage with the short necked stems desired alike by market men and exhibitors, combined with a ready tendency to develop brilliant colour. The good influence of the best forms in *Poeticus* are also apparent to the practised eye, e.g., the fine quality and substance of *N. poeticus recurvus* or the neat and broad petalled circular form of *N. poeticus verus*; again the White Trumpet strain would seem to have a definitely refining influence upon quality and texture.

I should say that I have never been trained in the science of plant genetics, and I feel that those equipped with the knowledge and skill resulting from a thorough course of training in that science are likely to have a great advantage over the older generation of breeders, and may be able to achieve desired objectives more rapidly and with less waste of effort. A skilled geneticist may well be able to trace from the number and character of the Chromosomes of a given variety the probable original source of some particular character or characters that it



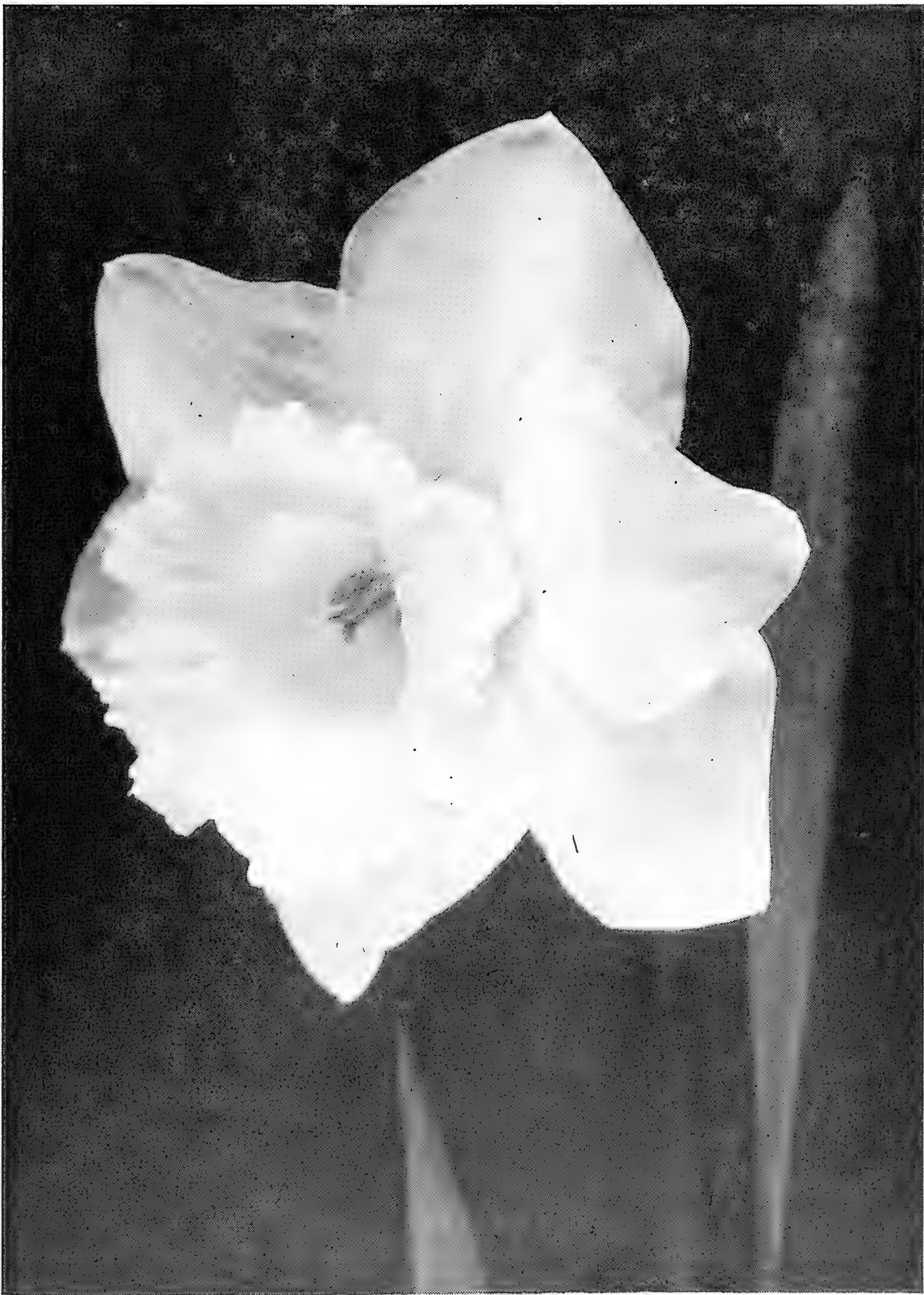
Hybrid Narcissus—Samite

Seedling of **Mrs. Krelage**; a beautiful ivory white trumpet of fine form and finish; First Class Certificate, R. H. S.

possesses and transmits to its progeny. I have recently had extensive correspondence with Dr. C. A. Walker of Nottingham, who is a plant geneticist; he has also been here at Daffodil flowering time, and I have been deeply interested in many of his deductions.

The old Incomparabilis *Princess Mary* which has been such an important factor in breeding was not a spectacular flower, and it had such a poor constitution that it has practically disappeared from cultivation, indeed I do not know of anyone in Great Britain who now has it. Its parentage is not known, but Dr. Walker thinks that *N. poeticus verus* probably figures in its pedigree, which may account for some of its virtues. Engleheart, probably being attracted by its orange tinted crown, mated it with the Poets and produced a number of small bright crowned Barriis which attracted a good deal of attention, as at that time red cups as we now know them were non-existent; but very few of these seedlings survived for any length of time as they had poor constitutions. Curiously enough, however, it was found that if *Princess Mary* was seeded to the pollen of the large trumpets, e.g. *King Alfred*, *Madame De Graaff*, etc. the resulting progeny was large and vigorous, of good habit, and often of good form and quality. Some things that came from crosses of that type were of much value in subsequent breeding, e.g. the yellow Incomparabilis *Golden Pedestal* which was raised by J. L. Richardson from *Princess Mary* x *King Alfred*.

A few of Engleheart's small crowned bright Barriis, which came from *Princess Mary* by *Poeticus* pollen, fortunately survived long enough to be of great value and importance to breeders. *Beacon* is the most notable of these: it is a little insignificant mean looking plant and flower, so nothing in the history of breeding has been more astonishing than the vigorous plants and large fine quality flowers which have come from first crosses between it and large vigorous things such as *Fortune*. P. D. Williams and A. M. Wilson discovered its possibilities and used it for some time before others were aware of them: it was also extensively used by the Brodie of Brodie. I am almost certain that *Beacon* came from a cross between *Princess Mary* and *Poeticus Recurvus*, as some of its seedlings, most notably P. D. Williams' beautiful *Folly* have much of *Recurvus* character. Dr. Walker confirmed this view on examining its chromosomes. The beneficial influence of *Beacon* on the quality and pose of many of its descendants is readily apparent. Another old flower used by P. D. Williams was *Firebrand*, a small Barrii with starry whitish perianth and small very vivid red cup. I had been told by the late F. Herbert Chapman that *Firebrand* came from *Princess Mary* x *N. poeticus poetarum*, and for years believed this to be its origin; but quite recently Mr. A. M. Wilson, who in early days had been in most intimate touch with P. D. Williams and Engleheart, told me that it came out of *Beacon*. Be that as it may, it is undoubtedly closely related to *Princess Mary*. The late J. C. Williams of Caerhays Castle, Cornwall, who was a cousin of P. D. Williams, and also at one time a noted breeder, succeeded in crossing *Firebrand* with *King Alfred*, and produced *Hospodar*, which was in turn largely used by P.



Hybrid Narcissus—Kanchenjunga (White Knight X Conqueror)

A very large white trumpet that has been valuable in breeding other large trumpets with wide full perianths; trumpet of this stately flower is serrated and widely flanged. Award of Merit, R. H. S.

D. Williams, giving him a wonderful series of brilliant red and yellow varieties, including such fine things as *Saltash*. It should be noted that in mating *Firebrand* with *King Alfred*, the good qualities deriving from the *Princess Mary* strain—via *Beacon* and *Firebrand*, and the *Maximus* strain—via *King Alfred*, were combined.

Brodie of Brodie raised a smallish neat Barrii which he named *Mozart*, from *Princess Mary* by one of his own seedlings. *Mozart's* almost flat crown is sharply rimmed with red which rather points to and confirms the suggestion that the sharply crimson rimmed *Poeticus verus* may be somewhere behind *Princess Mary*. From *Mozart* by pollen of *Gallipoli*, which was bred between *Bernardino* and *Will Scarlett*, Brodie raised *Seraglio* and *Therapia*; of these two *Seraglio* has proved a most valuable seed parent and many very fine flowers have been bred from it, such as *Market Merry*, *Dunkeld*, *Garland*, *Green Island*, etc., the *Princess Mary* influence behind it being apparently strongly dominant. It is still worthwhile mating it to the best of recent productions.

The neat little yellow perianth Barrii *Gulliver* was one of P. D. Williams' earlier productions. I don't know how it was bred, but it has excellent form and texture and I should not be surprised if it came from *Beacon*, while Dr. Walker thinks it has much of *Poeticus verus* character. At all events the very fine Incomparabilis *Carbineer* was raised by A. M. Wilson from seed of *Gulliver*; and *Carbineer* has in turn proved itself a parent of great value both as pollen and seed parent: J. L. Richardson of Waterford, Eire, has raised a series of magnificent red and yellow Incomparabilis from *Carbineer* by pollen of *Porthilly*; vigorous plants of fine habit, high quality and magnificent brilliant colouring.

I have found the Barrii *Market Merry* a most useful flower in breeding brilliant yellow and red colouring. *Market Merry* was bred by Brodie of Brodie from *Seraglio* by pollen of a seedling he had raised from *Tamerlane* by *Fortune*. *Tamerlane* was bred from *Firebrand* by *King Alfred*, and was a sister seedling to *Hospodar*, already mentioned, but it never got into general cultivation, as it had much less colour in its cup than *Hospodar*. *Market Merry* is a very brightly coloured flower, and a little reflection will show that it inherits a lot of colour on both sides of its pedigree. I crossed it with the pollen of a smallish but very brilliant yellow and orange scarlet Incomparabilis of P. D. Williams' raising, and got a nice batch of seedlings of which the two best were *Indian Summer* and *Chungking*, both flowers of fine form with broad overlapping deep golden perianth and intensely vivid orange scarlet crown. *Indian Summer*, which is really a small cupped Incomparabilis, holds its colour better of the two, but has the fault of a long though stiff and wiry neck. Among my most recent seedlings are some resulting from crossing *Indian Summer* with Richardson's magnificent red and yellow *Bahram*—a short necked flower bred from *Penguite* by *Porthilly*, also *Carbineer*, besides one or two other short necked red and yellows of my own raising: some of the resulting seedlings promise to be very fine, as *Indian Summer's* long neck has been corrected, while they have beautiful quality and magnificent brilliance and intensity of

colour, in one or two cases I think even deeper than that of *Indian Summer*; but as the most of them have so far only flowered once it is rather soon to form a just opinion of their merits. From *Chungking* by pollen of a tall vigorous yellow and orange red *Incomparabilis* of fine substance and quality named *Klingo* I have in the past season flowered a couple of four year old seedlings which promise to be very fine, so it looks as though this strain is worth going on with.

A great many years ago Engleheart made a cross between *Poeticus Poetarum* and the Wild Trumpet *Abscissus* or *Muticus*, and produced *Will Scarlett*, which he said was the smallest of a family of enormous and coarse brethren. *Will Scarlett* made a great sensation on its appearance, as it was the first all red cup of any size; but it really is a shockingly bad flower, and on the whole I think it was unfortunate that it ever appeared, for it transmits many faults to successive generations of its descendants. Of its parents *Poeticus Poetarum*, though it has a very vivid wholly orange scarlet eye, has a terribly poor thin spidery perianth; while the rather curious Trumpet *Muticus* has also a poor and muddy coloured perianth, and a peculiar long narrow stove pipe trumpet. The temptation to use *Will Scarlett* to obtain striking red cups was too strong for some breeders, though I don't think that Engleheart himself ever used it, and neither P. D. Williams or J. C. Williams ever had it on their places. Mrs. R. O. Backhouse, however, must have used it freely, and she undoubtedly produced many striking and spectacular flowers of remarkable colouring, but in the case of yellow perianthed varieties the petal colour was always somewhat muddy and lacked the clearness, depth and brilliance of P. D. Williams' strains which had *Maximus* instead of *Muticus* behind them. Mrs. Backhouse's strain had undoubtedly great vigour, but they had a tendency to make rather large soft long necked bulbs which are not a good type for commercial handling. The bulk of her stocks eventually came into the hands of Dutch growers who propagated them and distributed them widely and a great many flowers undoubtedly have this strain behind them. Some of the worst faults of the *Will Scarlett* strain are roughness or unevenness of perianth, muddiness of petal colouring, and often disproportionately wide and gaudily coloured crowns which quite frequently have occasioned wart-like excrescences at their edges, or ugly and unwanted spots of pale yellow appearing in their orange ground colour, giving an unpleasant piebald effect, and making up coarse and vulgar looking flowers. By mating varieties of the *Will Scarlett* strain with others of the *Princess Mary* strain, more particularly of course if the progeny of such crosses are again bred to the better strain, it has often been possible to eliminate or at all events mask the faults of *Will Scarlett*.

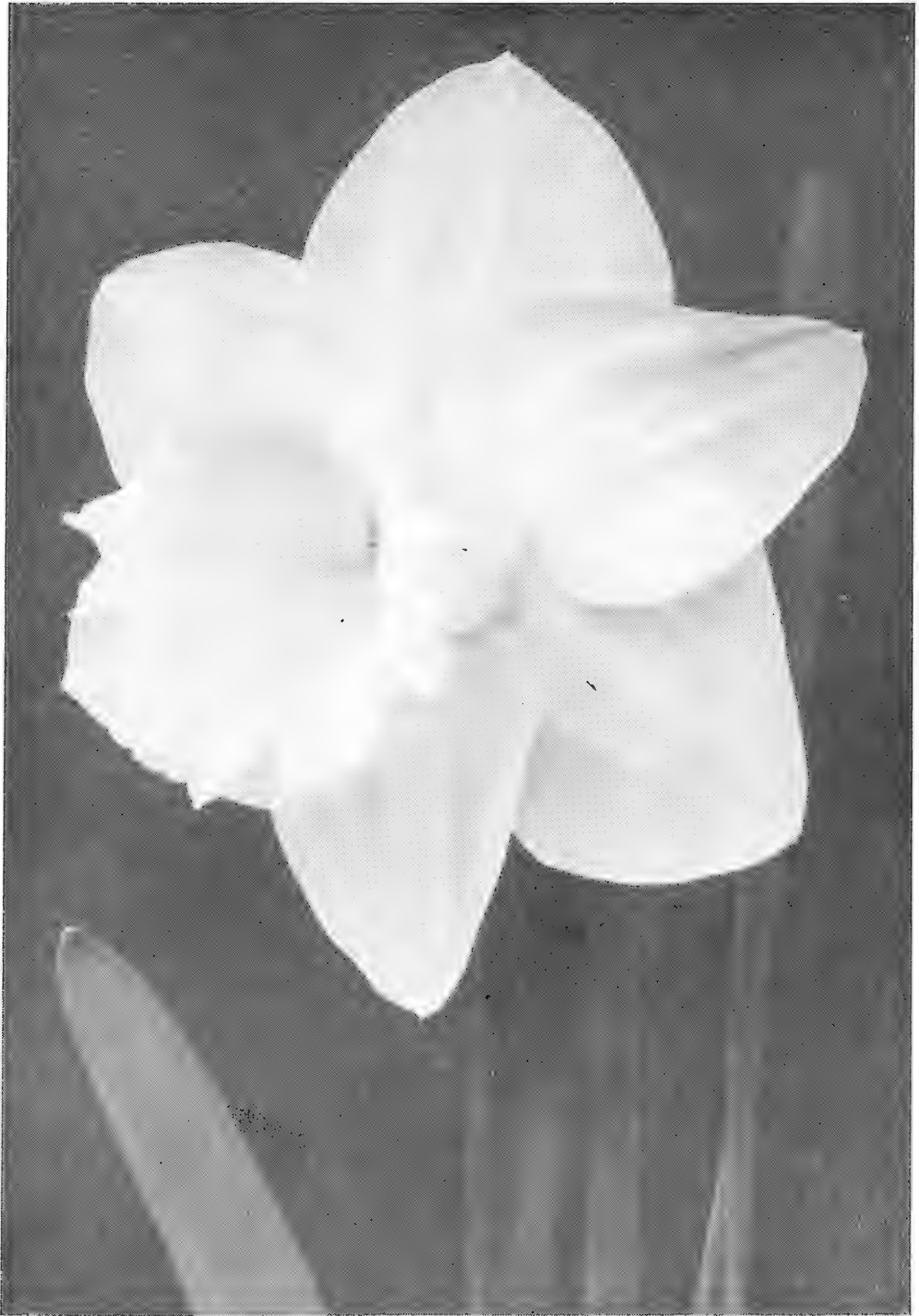
The late F. Herbert Chapman of Rye, Sussex, attempted to correct *Will Scarlett's* faults in a first cross by mating it with *N. Poeticus Verus*. From this cross he got *Crimson Braid*, a white petalled dark red rimmed *Barrii*, which he subsequently used in further breeding. *Crimson Braid* had considerable substance, but its perianth still reflexed very badly. Chapman used its pollen on *N. Poeticus Kestrel*, and got a series of

striking white perianthed Barrii-Poets with very rich coloured eyes; but even they lacked something in refinement. He also used *Crimson Braid* pollen on *Princess Mary* and got a very charming little Barrii which he named *Dinkie*, of excellent form and quality and of a most distinct and attractive soft clear rather greenish lemon colour, with a sharply defined narrow red rim to its small crown.

Probably the best known flower which came from the late Mrs. Backhouse's garden is *Incomparabilis Hades*, which has attained great popularity on account of the extraordinary depth and brilliance of colour of its almost cherry red cup. It has the fault of a rather floppy and muddy coloured perianth, though it is less coarse than many of the breed; it also has rather soft foliage and a long necked bulb, but its pollen has been of considerable value in breeding; e.g. J. L. Richardson got the splendid brilliant white and scarlet Barrii *Limerick*, which gained a First Class Certificate this year, by using *Hades* pollen on P. D. Williams' *Incomparabilis Folly*. Mrs. Backhouse must have bred some of her strain back to the best Poets, such as *Recurvus*,* as the best quality flowers which came from her garden were smaller crowned things of the Barrii and Barrii-Poet class; e.g. *Lidcot*, *Sunstar* and *Coronach*. *Sunstar* has been of much value in breeding, especially as a pollen parent, and tends to give flowers with very white perianths, whiter than its own. From its pollen used on *Beacon*, the Brodie of Brodie got *Pera* a most perfect small deep red and pure white Barrii, while by using it on *Folly*, Richardson got *Mahmoud*, one of the very best and most faultless deep red and pure white Barriis yet seen, and from the same cross I got *Bravura* (Plate 289), a really magnificent large pure white and red Barrii. *Coronach* is a flower of superb colour, real snowy "blue-white" perianth and small deep crimson eye: unfortunately it is a rather uncertain doer. Nevertheless Richardson has bred some very good things from its pollen, and Frank Reinelt tells me that he is using it extensively, so I expect soon to hear of some good results from him.

P. D. Williams had a late flowering small crowned 4B Leedsii which he called *Silver Coin*. I remember he used to tell me that it gave most beautiful seedlings. I did see just a few charming things from it when I used to go to see his flowers in March, but that was too early for most of the *Silver Coin* seedlings, and he said he had much better ones that flowered later. He gave me a few bulbs of *Silver Coin*: it is a small white flower, not much to look at, as it has the habit of seldom opening perfectly, and coming with green tips to its perianth; but it has much substance and a good stem and short neck: unfortunately it flowers very late, so that unless one tries to preserve pollen to use on it there is not

* Editorial Note.—According to Mr. W. O. Backhouse, who recently visited the United States, his mother, Mrs. R. O. Backhouse, never made any crosses with *N. Poeticus recurvus*. Her brilliant red cups originated in a cross between the Tenby Daffodil and *Poeticus Poetarum*. Five or six seedlings were obtained from this cross, of which three had red cups. Two were given the names, **Ladybird** and **Firelight**, both 2A, the latter being given an Award of Merit on March 16, 1903. Only one of these red cups was fertile, **Ladybird**, which Mrs. Backhouse used again and again. Hence, **Ladybird** was the real source of all her many red-cupped flowers.—Arno H. Bowers.



Hybrid Narcissus—Broughshane (Trostan X Kanchenjunga)

A very large white trumpet with extremely wide perianth segments which form a good background for the large trumpet; perianth is 5½ inches across when well grown; Award of Merit, R. H. S.

Plate 288

much choice of things with which to cross it. I did cross it with *Silver Plane* and *Crimson Braid*, getting nine and seven seeds respectively: and with another flower which I had bred from a large Leedsii by pollen of *Crimson Braid*; this flower I called *Armoy*: it had a flat even perianth of thick texture and quite exceptional smoothness and a smallish neat yellow cup; like *Crimson Braid* it flowered very late, and I finally discarded it as it made such very poor soft bulbs. Turning again to the crosses between these three things and *Silver Coin*, I was astonished to get from the *Crimson Braid* pollen several most vigorous and very late 4B's with all strong short necked stems and flowers of quite exceptional substance; they had very good perianths, but the small crowns of some contained thick petaloid anthers or in some respect did not quite come up to requirements: none of them inherited any colour from *Crimson Braid*'s dark red rim. The best one of them, which was No. 28/101 was an icy white green eyed 4B, rather like my lovely 4B *Cushendall*, but taller and more vigorous and free of increase, though not so perfect a flower. From *Silver Coin* x *Silver Plane* came several late flowering large 4B's of enormous substance with broad thick petals and short frilled crowns, strong stiff stems and very short necks; none, however, were considered good enough to name. It should perhaps be mentioned that the quantities of seed obtained from the few available flowers of *Silver Coin* were small. From *Silver Coin* x *Armoy* I got fifteen seeds: presumably most of these were really selfset, as only one came that was obviously the cross, but this was a beautiful flower with faultless white perianth of flawless texture, and great substance, and a neat little pale primrose or ivory crown, it is moreover a plant of good habit with perfect stem and neck: this won the medal as the best flower in the London Show in 1943, and was subsequently named *Tryst*. It may be interesting to state here that Dr. Walker feels pretty certain that *N. poeticus verus* is behind *Silver Coin*; I think that this is more than probable, and if it be so the above mentioned seedlings by pollen of *Crimson Braid* and *Armoy* must have a double dose of *N. poeticus verus* in their make up. I have this year flowered some really beautiful seedlings from No. 28/101 by pollen of Richardson's magnificent *Green Island*—bred from Leedsii *Gracious* by *Seraglio*—of which some four have been selected for further trial: all of these have excellent smooth white perianths of splendid substance and very pale cool citron shallow crowns or eyes edged with bright orange, and in one case scarlet; so in these the *Crimson Braid* or *N. poeticus verus* rim of colour has returned modified and with charming effect on a very pale ground; which, assuming Dr. Walker's guess that *N. poeticus verus* is behind *Princess Mary*, the grandmother of *Seraglio*, is not surprising, because of course it is also behind No. 28/101.

A good number of years ago a flower of a lovely shallow crowned *Silver Coin* seedling was sent me from P. D. Williams' garden. I used its pollen on *Silver Plane*, *Nelly*, *Mitylene* and a *Silver Plane* x *Mitylene* seedling, and got quite a number of really good things. The best of them all was *Chinese White* (Plate 290), which came out of *Silver Plane*

and is still the finest 4B I have yet seen. From *Nelly* came *Foggy Dew* and *Carnalea*, both beautiful flowers: the influence of *Silver Coin* in the pedigree of these things is most pronounced and very beneficial.

From pollen of *Chinese White* (Plate 290) used on a white seedling bred from *Quartz* (*Morven* x *White Emperor*) by *Naxos* I got a very good 4A Leedsii of much substance, excellent form and proportion, a pure clear self white with a shade of cool green in the base of the crown. This plant, which is known as *No. 30/90*, has a very sturdy habit, with stiff stem and short neck and peculiar stiff dark green upright foliage: I have not yet named it, as the crown sometimes comes a little rough. I may mention here that I am pretty certain that *N. hispanicus maximus* is somewhere behind the breeding of Engleheart's white Leedsii *Naxos*: if that be so, the using of *Naxos* in this case blends the *Maximus* character with the *Silver Coin* strain. *Naxos*, it may be mentioned, though not one of the very whitest flowers, seems to have the faculty of giving the most beautiful icy whiteness to a proportion of its progeny—e.g. *Ludlow*, *Zero*, etc., *Maximus* influence would seem to be evident in the hardening of the texture of stem and foliage in *No. 30/90*. I have been using the pollen of *No. 30/90* and have among my most recent seedlings flowered for the first time in 1946 some very promising and beautiful flowers: e.g. from *No. 28/65*, a seedling from *Nelly* by a large 4A, which was a very nice white Leedsii but had a much too long neck and a rather weak stem, by pollen of *No. 30/90* I got some very good white 4A's, all of which were flowers of excellent proportion and remarkable substance, and strong stemmed, short necked sturdy plants. Descriptions of one or two of these from my field note-book read as follows:—*No. 35/106*. "Splendid pure white Leedsii of very good substance and pose."—*No. 35/107*. "Most perfect snow white Leedsii with smallish smooth bowl shaped crown: very nice proportion."—*No. 35/149*. "Pure white Leedsii; green in base of crown, very nice form and proportion, short neck."—and so on. *White Maiden*, a rather distinct Leedsii of somewhat drooping habit with broad perianth and a rather shallow saucer crown, mated to *No. 30/90* also gave nice things—e.g. *No. 35/144*, "Lovely smooth medium crowned snow white Leedsii"—*No. 35/166* "Very graceful beautifully proportioned large white Leedsii." Another cross which is interesting was made between a pure white 4B that I call *Stardust* x *No. 30/90*; *Stardust* is a sister flower to *Chinese White*, and as *No. 30/90* has *Chinese White* as its pollen parent the close relationship can be seen, and also that in mating these two, one gets a double dose of *Silver Coin* blood. I recollect that the seed from this cross, of which there was only a quite small quantity, looked particularly large and fine. The seedlings were vigorous from the outset, and those that have flowered are only 4 years old: they have very strong stems and stiff strong foliage, and they are all large beautiful very white shallow crowned flowers of splendid substance and quality. It would appear from these results that it would be well worth while using the pollen of *No. 30/90* on a wider range of flowers; and it is also easy to imagine further progress resulting from breeding from its progeny. Another

cross which this year gave some most charming and beautiful high quality seedlings at four year old was *Seraglio* by pollen of *Stardust*—thus blending the *Princess Mary* strain with the *Silver Coin* strain. These also were large flowers of the shallow crowned type of great substance and quality, the crowns varying from white to pale citron with charming pale buff or pale gold frills. I think we have struck a good line for combined quality and vigour in this *Silver Coin* strain.

Earlier in this paper I said that the White Trumpet strain seems to have a refining influence. I think we can take it that the original parent of White Trumpet Daffodils is the lovely drooping little white *Narcissus alpestris*, which is probably better known as *N. Moschatus* of the Pyrenees. It is pretty obvious that other wild white Spanish Daffodils, e.g. *Colleen Bawn*, *Cernuus*, etc. are closely related to *Moschatus*, while the old Dutch raised *Albicans* is almost certainly one of its children or grand-children. The once famous white Daffodil *Madame De Graaff*, a most lovely refined thing in its day, was known to be bred between *Albicans* and the very vigorous growing Bicolor Trumpet *Empress*. *Madame De Graaff* was, of course, very extensively used in breeding, and many self fertilized seedlings must have been raised from it: amongst these such things as *White Knight* and *Mrs. Robert Sydenham* appeared. These were small flowers by today's standards, but they had very beautiful quality of texture and were much whiter than *Madame De Graaff*. Engleheart raised his very fine and now well known *Beersheba* from *White Knight*. The great Leedsii family arose in the first instance as a result of blending the blood of the White Trumpets with the *Poeticus*. In due course this original first generation Leedsii were again mated with *Madame De Graaff*, *Weardale Perfection* and other large trumpets, and gave rise to a beautiful race of large Leedsii which have, of course, been further developed, and have also been mated with very fine results with the *Princess Mary* and *Beacon* strain, and as has already been seen with the *Silver Coin* strain. Amongst the Leedsii many flowers of most beautiful quality can be found.

Pure bred large Yellow Trumpets as a family are with one or two exceptions rather inclined to coarseness; the most notable exception was *King Alfred*, a noble plant which owes its good qualities to its parent *N. Hispanicus Maximus*, whose influence predominates in *King Alfred*. The now well known and popular White Trumpet, *Mrs. E. H. Krelage*, was bred by the firm of Krelage in Holland, by *King Alfred* by pollen of *Madame De Graaff*. This flower was first shown at the London Royal Horticultural Society's Daffodil Show in 1912, when it created a sensation on account of its wonderful substance and beautiful waxy texture: it was in fact a blend of the best *Maximus* yellow trumpet strain with the further refining White Trumpet strain. I should think that even yet *Mrs. Krelage* is worth breeding from. It is the parent of my own First Class Certificate White Trumpet *Samite* (Plate 286), a very vigorous growing White Trumpet of superb quality; and I believe it to be the grand parent of another F. C. C. White Trumpet of mine,



Hybrid **Narcissus**—**Bravura (Folly X Sunstar)**

A large Barrii of great charm and grace, with a broad very white perianth and a well balanced orange scarlet flattish crown.

namely *Cantatrice* (Plate 285), which is still about the highwater mark for refinement and flawless beauty of texture. *Cantatrice* was bred between *Beersheba* and *Eskimo*, the latter a seedling of Brodie of Brodie's raising, which has *Mrs. Krelage* as one of its parents.

Brodie of Brodie raised a flower named *Nevis*, an almost White Trumpet which has proved of great value in breeding. On one occasion Engleheart sent him a small pinch of pollen of a white Daffodil which he said he thought had *N. triandrus* in its pedigree; Brodie's season in the north of Scotland was much later than Engleheart's, and when this pollen arrived, the only thing of any note that was in bloom in his garden was a large early yellow trumpet bred between *King Alfred* and a Dutch Bicolor Trumpet called *Glory of Noordwijk*. He put Engleheart's pollen on this and got *Nevis*, which was distinguished by remarkable thick smooth waxy texture. By using *Nevis* pollen on *Beersheba* he got the very fine large White Trumpet *Corinth*, a flower of great substance, and by using it on a seedling bred between the two Bicolor Trumpets *Weardale Perfection* and *Duke of Bedford*, he got that most noble and very large white or almost white trumpet *Askelon*, a flower that has magnificent breadth of petal, great size and most beautiful quality, which has in turn been of great value in breeding. It is the pollen parent of my *Kanchenjunga* (Plate 287), a remarkable giant flower with enormous breadth of petal, which in turn became the pollen parent of my giant white *Broughshane* (Plate 288). *Nevis* unfortunately makes rather a soft bulb; this fault is inherited to some extent by *Askelon* and *Kanchenjunga*, but is eliminated in *Broughshane*, whose other parent is *Trostan*, a very fine tall bicolor which I think came out of *King Alfred* by *Askelon* and therefore has a good deal of Maximus blood of which indeed *Askelon* itself has a trace, seeing that its grandparent, Brodie's Yellow Trumpet seedling, was a child of *King Alfred*.

The best modern Yellow Trumpets owe their quality to an admixture of White Trumpet blood in their ancestry. Take *Royalist* for example, a medium size Yellow Trumpet of faultless form and wonderful smooth texture. This was bred from *Cleopatra* by *Broadford*. *Broadford* came from *King Alfred* x *Lord Roberts*: *Lord Roberts* was a broad petalled Yellow Trumpet of very good form, which was bred from the Yellow Trumpet *Monarch* by *Madame De Graaff*. *Royalist* has proved to be a parent of great value, transmitting fine form, texture and quality to its progeny. By mating it with *Crocus* and *Trenoon* Richardson has raised a series of very high quality golden trumpets. Another interesting example is *Hebron*, bred by Brodie of Brodie from *White Emperor* by *King Alfred*. *White Emperor* is a very symmetrical White Trumpet of first rate smooth texture. *Hebron*, curiously enough, is if anything a deeper gold than *King Alfred*, and is a flower of smooth texture, though its petals incline to droop forward rather much; but it has given some excellent seedlings of high quality, notably *Cromarty*, bred by Brodie of Brodie from *Hebron* by *Alchemist*, a pure gold flower of faultless form, carriage and quality, which is in turn giving fine

seedlings: also such things as my own *Golden Hind* and *Virtue*, which came from *Hebron* by *Crocus*. This year a small batch of seedlings from *Golden Hind* by pollen of a seedling from self fertilized *Trenoon* show very high quality. In both of these strains, i.e. *Hebron—Crocus—Trenoon* and *Royalist—Crocus—Trenoon* we have a predominant *Maximus* via *King Alfred* yellow strain leavened by a trace of refining white trumpet quality.

Nothing has aroused more interest in comparatively recent years than the appearance amongst seedlings of the Leedsii and Leedsii-White Trumpet strain of occasional flowers with faintly pink tinted crowns. I guess one of the main origins of pink to have been the Bicolor Trumpet *Weardale Perfection*, which had a just discernible tint of soft warm creamy buffness in its pale yellow trumpet—which may trace back to the very slight buffness noticeable in some examples of the wild Yellow Trumpet *Abscissus* or *Muticus*, which I think is more than likely one of the first parents in the Weardale line. The old Leedsii *Minnie Hume* was mated with *Weardale Perfection*, and one of the resulting progeny was the Leedsii *Lord Kitchener*, which in turn gave several things with pink tinted crowns, the pink I suppose resulting from the blend of Weardale's warm cream with diluted *Poeticus* red. I think that pink may possibly arise from some other sources as well, but time and space forbid further speculations about them. What is now perhaps of more immediate interest is that once pink has appeared it seems possible to reproduce it in gradually increasing strength of colour and frequency by inter-crossing pink tinted things: one will of course get a lot of seedlings without any pink, but a proportion of pinks can reasonably be hoped for, at all events that is my own experience. Mr. C. E. Radcliff, of Hobart, Tasmania, to whose outstanding work in the development of pink crowned flowers I have already referred, tells me that he flowered a small batch of seedlings this year bred from two of his pink crowned things, and that every one of the seedlings had pink crowns. He also tells me that he is gradually getting stronger and purer tones of pink, and often combined with beautiful pure white perianths.

I have long had a special affection for the late flowering small crowned Leedsii or 4B class of which some of the first to be introduced were Brodie of Brodie's *Silver Salver* and *Samaria*, and my own *Mystic*. The latter was bred from pollen of a fine large circular *Poeticus* seedling of Engleheart's raising on one of the old type Leedsii. I crossed *Mystic* with pollen of *Poeticus Dactyl*, a very fine tall late Poet of splendid form, carriage and substance, raised by Engleheart, and got a whole series of charming and dainty things, such as *Grey Lady*, *Columbine*, *Misty Moon*, *New Moon*, *Dreamlight*, etc. I also used the pollen of *Dactyl* on a small flower of Engleheart's raising called *Emerald Eye*, which was a poorish doer and has I fear disappeared: it had very white perianth and small crown with a green eye: from this cross I got two of the best things I have raised, namely *Cushendall* and *Frigid*; both are late flowering small crowned 4B's of faultless form, quality and carriage. *Cushendall* has a perfect circular poeticus white perianth

and very shallow saucer crown edged with a cream coloured frill, while the centre is a lovely moss green; when I saw how good it was I repeated the cross and got *Frigid*, an even later and larger flower with broad but rather more pointed petals of the purest frosty white, and a small crown equally white with a touch of vivid emerald green in its eye; as it flowers as late as *Poeticus Recurvus* so it is never seen at Shows. These green eyes are very enchanting and are evidently capable of further development as at the London Show in 1945, Mrs. Vyner Ellis of Minsterworth Court, Gloucestershire brought me a flower to see which she had bred from my Poet *Cantabile* by pollen of *Cushendall*. *Cantabile*, though of course it has a rim of red to its eye, has more green than any poet I know; Mrs. Ellis' seedling was a thing of exquisite beauty, about the same size as *Cushendall* with a faultless *Poeticus* perianth of purest sparkling snow-white, while the eye was wholly vivid green except for a white fringe. At the same Show Mr. D. Blanchard of Blandford, Dorset, exhibited two remarkable flowers bred from my *New Moon* by *Sorello*, another small 4B of Brodie of Brodie's raising; the eyes of these flowers were entirely grass green without any rim of any other colour. One would like to see the jewel-like colouring of the exquisite eyes of these 4B's, not only the entirely green ones but those that are white, or faint greeny citron, or grey, green, or green centres, with rims of gold, orange, salmon, pink or cerise, carried into larger crowned flowers. I think this is not an impossible development, but it may not be easy of attainment as these charming 4B's are so late that almost all the larger things are over before they come out; moreover, unlike *Silver Coin* they seem unwilling to mate with the larger crowned things, but I dare say something further in this direction can be done with the help of the *Silver Coin* Strain.

I have hitherto omitted all mention of the most charming and delightful miniature Narcissi, such as *Minimus*, *Cyclamineus*, *Triandrus*, *Juncifolius*, *Jonquilla*, etc. as I have never done any work upon them myself, but Mr. Alec Gray of Treswithian Daffodil Farm, Camborne, Cornwall has made a specialty of them and is intercrossing them and has already produced many exquisite refined and dainty fairy-like little dwarf Daffodils suitable for rock gardens or alpine house culture; many of them have the additional charm of delicious perfume. I have no doubt they could be successfully bred in California, and probably also in Oregon and elsewhere in U. S. A. I would refer interested readers to a most informative and comprehensive paper by Mr. Gray on Miniature Daffodils in the issue of the R. H. S. Journal for June 1946 (Vol. LXXI part 6).

Early in this paper I suggested that breeders should work on those strains that they found best adapted to their particular conditions of soil and climate. I gather from Frank Reinelt's correspondence that he has already put this principle into practice, and has selected a comparatively limited number of varieties as the main foundation of his work. He has been making extensive use of the fine tall stemmed golden *St. Issey*, also *Tunis*, *Polindra* and *St. Egwin*, all of which were raised



Hybrid Narcissus—Chinese White (Silver Plane X Silver Coin)

An exquisitely beautiful large flat crowned Leedsii; clear pure white throughout, except a touch of green in center; delicately saucer-shaped crown is nice contrast to wide-petaled, almost circular perianth. Award of Merit, R. H. S.

by P. D. Williams, and of the tall early flowering Australian raised *Jean Hood*. I am particularly interested to know that he has developed a *Tunis* strain: I do not know how *Tunis* was bred, but feel pretty certain that *Maximus*, probably via *King Alfred*, enters into its pedigree. It is not really happy in my cold climate, but I have seen it in fine form in Cornwall and consider it an outstanding plant on account of its fine habit and the substance and durability of its flowers: Its stem is very tall, strong and short necked giving the large flowers a good pose. Its foliage is of the hard type which is resistant to fungoid troubles, and it makes a quite exceptionally hard bulb remarkably heavy for its size. From what Frank Reinelt tells me I think he has already some remarkably fine things amongst its descendants.

Some interesting lines of development remain largely unexplored. P. D. Williams left us a few most attractive and refined things resulting from crossings with *N. Jonquilla*, the small sweet Jonquil; such as *Lanarth*, *Hesla* and *Trevithian*: of these three *Trevithian* appears to be much the best doer, and is likely to become a very popular garden plant: it has the distinctive Jonquil character in its foliage, and habit of bearing one to three flowers on the stem; the clear yellow flower itself is charmingly smooth in quality and refined in form. Quite a lot more hybrids have recently appeared as a result of using the pollen of the small Jonquil on various things; some of these are beautifully neat and attractive in form, and some have quite bright orange red cups; but I have never yet heard of anyone achieving a secondary cross from these hybrids mated again with the large flowering types. I imagine such crosses would be difficult in our climate but should not be surprised if they were found to be quite possible in California. I should immensely like to see crosses between *Trevithian* and such things as *Havelock*, *Trenoon*, *Crocus*, *St. Issey* and some of the best quality red and yellow *Incomparabilis*. I imagine that if a strain of larger flowers could be developed with the blood of the small Jonquils in its pedigree, it would in all probability have distinctive character and much refinement of form, quality and colour. There is already a variety called *Golden Goblet* which I believe originated in Holland, which I think may be a secondary cross from some hybrid of *Narcissus Odorus Rugulosus*. It is an interesting plant, as it comes pretty near trumpet size and form, yet it retains a good deal of distinctive Jonquill character: it is a flower of almost trumpet form and intense self golden colour combined with great and most durable substance. I can imagine it doing much better in California than it does here, and that it might there be used with good effect in breeding. Another most desirable line might be developed from *Cyclamineus*. There have been quite a few small hybrids between *N. Cyclamineus* and Yellow Trumpet varieties that have most distinct and attractive form, excellent texture and fine golden colour: it should be quite possible to intercross them again with our best large garden flowers, such as *St. Issey* etc. and one can imagine a race of very high quality yellows resulting; moreover it might well be possible to get red into their trumpets, as I recollect long ago seeing in a friend's garden

a sport or seedling from *N. Cyclamineus* which was exactly similar to the parent in size and form but had an orange trumpet.

New and unexpected breaks such as the pink crowns will undoubtedly turn up from time to time, but even apart from such breaks with the great amount of material already to hand the possibilities are literally infinite, and the fascination of following them up and developing them is never ending and sufficient to provide Daffodil lovers with interest and delight for all time.

THE DAFFODIL IN AUSTRALIA—SOME RECENT DEVELOPMENTS

HAROLD ALSTON

Braemar, Diamond Creek, Victoria

The quest of the perfect Daffodil still goes on in Australia. Despite the exigencies of the war period and the shortage of efficient labour, daffodil growers throughout the Commonwealth have kept on steadily producing new varieties. They have also managed to keep together and in good health many of the older sorts. Although the standard of show flowers has reached such heights of perfection that it would seem impossible to find something superior each season amongst the many thousand seedlings; new beauties appear year after year to compete with their once unsurpassed parents on the show bench. Raisers each season make new crosses striving after the ideal flower though what this ideal is none can say. Even the most perfect daffodil may have something lacking which the raiser thinks could be improved upon in a future generation. New varieties are coming forward each season and it is expected that the first of the war-time seedlings will be making their appearance on the show benches this spring.

Naturally imports of new varieties from overseas have been limited owing to import restrictions so that growers have had to work with well-tried and acclimatised varieties raised prior to 1939. The demise of several noted raisers has thinned the ranks of experienced growers but in most cases they have left a legacy of first-rate flowers for those who follow to work with; and the fact that the gaps are being filled with young and enthusiastic daffodil lovers who will profit from the work of those who have gone, predicts a safe future for the daffodil in Australia. Some idea of the enthusiasm of these younger growers may be gained from the fact that one prominent amateur in Tasmania has this season set out 22,000 two year old seedlings all from flowers hand-pollinated with a definite objective in view. Others, however, limit their sowings to a thousand or so depending on the seed harvest and space limitations.

So successful have some growers been that when exhibiting they place reliance on seedlings of their own raising rather than named varieties from overseas. This does not mean that overseas productions are decried, far be it, as had it not been for the productions of British and Dutch bulb growers they would not have had the material with which

to work. The high prices asked for new novelties, however, act as a deterrent to the amateur who is already satiated with the multiplicity of extravagantly priced varieties, and who although eager to try his hand at the production of new varieties from seed, is not in a position to expend a large amount on bulbs which may or may not produce the desired results under Antipodean conditions, and which take from two to three years to become acclimatised and settle down. Despite this handicap amateurs throughout the Commonwealth and the Dominion of New Zealand are producing varieties that can hold their own and in some cases surpass those of overseas raisers. In fact several have already received high commendation in Great Britain. After a careful survey of the magnificent specimens to be seen on the show benches to-day, the acme of the plant breeder's skill and of cultural practice, it seems that raisers frequently overlook those characteristics of the garden plant which are not essential for exhibition purposes. The old idea that the perfect show flower would be out of place in a garden has gone by the board, and it has been the aim of Australian raisers of recent years to produce flowers of size and substance without the loss of form and balance with tall strong stems, short necks and above all strong constitution. The flowers should have long stems, the petals be strong in texture and substance, the neck of the flower should not be long and willowy, but short to withstand heavy rains and strong winds. Stiff upright foliage is the best. Refinement and quality, although exhibition points must be preferred to coarseness and size, and the balance between the corona and perianth must be maintained. These are points just as important in a garden flower as one for exhibition purposes.

Daffodil growing in Victoria got its send-off in August 1892 when the Royal Horticultural Society of Victoria held its first all bulb show in The Melbourne Athenaeum. This combined with the activities of the late Mr. Walter J. Smith of Riddell, Victoria and the publicity given to the flower by the celebrated actor Mr. George S. Titheridge stimulated public interest. In 1897 Mr. Alister Clark of "Glenara," Bulla, Victoria and Sir Heaton then Mr. Heaton Rhodes were members of a syndicate importing the latest productions of the great English raiser the Rev. Geo. H. Engleheart. Among their first introductions were *Albatross*, *Dante*, *Bennet Poe*, *Lucia* followed by *Flambeau*, *White Queen*, *Seneschal*, *Solfatarre*, *White Lady*, *Noble*, *Lady Mgt Boscawen* and *Great Warley*. In the meantime Mr. Titheridge had been amassing a collection of both species and garden hybrids and on his departure for England in 1898 sold his collection and the late Mr. Leonard Buckland of "Keyham," Camperdown and Mr. Alister Clark purchased the bulk of his bulbs. Rapid progress was made and on Mr. Titheridge's return ten years later, when he judged the flowers at the Melbourne show, he was astounded at the excellence of the seedlings on exhibition. Since then much water has flowed under the bridge and varieties which graced the show benches of those days would be today regarded as curiosities. Prominent growers at this period were the late Mr. Henry Boyce, the late Mr. James Lang of Harcourt and Mr. C. A. Nethercote of Hawthorn, the present treasurer of the Royal Horticultural Society of Victoria, and who although an octagenarian is still raising seedlings and



Hybrid pink-crowned **Narcissus**—(Left) **Kuranja**; raised by C. E. Radcliff, Hobart, Tasmania. (Right) **Pink a Dell**; raised by H. A. Brown, Mount Macedon, Victoria, Australia.

judging at shows. Mr. Boyce's memory is perpetuated in the Henry Boyce Memorial trophy awarded for the best twelve seedling daffodils not in commerce and raised by the exhibitor, which annually is keenly contested. For many years the Late Mr. Buckland was successful and many of his productions figure in the ancestry of modern seedlings. His first notable success was with a white-perianthed incomparabilis which he called "*Pink Un*," a seedling from *Mary Magdeleine de Graaff* which sported with him showing a tinge of pink in the corona. From *Pink Un* several notable seedlings have been produced. Of late years the late Mr. D. V. West of Casterton was the most successful raiser of seedlings and on his death was followed by his son-in-law, the late Mr. Hubert Fell. He produced many fine trumpet daffodils and later some splendid incomparabilis in which *Bernardino* figured prominently in their pedigrees.

Mr. Nethercote and his friend the late Mr. Scott Morrison of Wandin, Victoria started growing daffodils in 1890 and Mr. Nethercote has been a consistent importer of new varieties ever since and has raised many seedlings, among them many beautiful flowers, but apart from distributing some to his friends has not disposed of any commercially. A severe critic, but good judge he like many others is still searching for his ideal flower. He and Mr. Alister Clark must be considered the doyens of the *Narcissus* world in the State. Mr. Clark's achievements are remarkable inasmuch as he has consistently worked with his own productions, using pollen of overseas varieties only on rare occasions. His development of and interest in the production of flowers of the Leedsii type with pink or pink edged coronas has resulted in the raising of many flowers of decorative beauty, and stimulated the interest of other growers in the development of pinks. Mr. C. E. Radcliff of Hobart, Tasmania already has to his credit several magnificent pinks of which the following varieties have all received awards: *Rosario*, *Kuranja* (Plate 291) and *Roslyn*. Mr. O. Ronalds of Tarago, Gippsland, Victoria has also been successful in raising pinks and last year his variety *Mrs. O. Ronalds* (Plate 292) when shown for the first time was accorded acclaim by all who saw it. It is a really fine flower borne on a tall strong stem with a pure white perianth with well overlapping segments and a pale rosy corona right to its base. Both Mr. Radcliff and Mr. Ronalds are producing flowers of outstanding merit which could successfully compete with the best of overseas productions. Dr. Jackson of Dover, Tasmania has also many fine flowers to his credit and although also an octagenerian is still sowing seed and keeping an accurate record of his crosses and the dimensions of the flowers he raises. Mr. Bisdee of Tasmania is also another enthusiastic seedling raiser as is Mr. Raphael of Hobart, and as the Tasmanian climatic conditions are particularly suitable many still finer flowers may be looked for in the future from that State. Mr. J. R. Byfield is also an enthusiastic grower and a noted judge in Tasmania while the late Mr. J. Hinsby was for many years guide and friend to young breeders.

Prominent hybridists in Victoria are: Mr. C. O. Fairbairn of "*Ganongill*," Skipton near Ballarat who has raised some fine seedlings



Hybrid pink-crowned **Narcissus** (Left) **Mrs. O. Ronalds**; incomparabilis, raised by Mr. O. Ronalds, Tarago, Grippsland, Australia. (Right) **Hugh Dettman**; **Leedsii** raised by Mr. Alistair Clark, Bulia, Victoria.
Plate 292

especially some from *Carbineer*; Mr. S. Mann of Ballarat a consistent exhibitor and the winner of many prizes; Mr. J. Davey also of Ballarat; Mr. A. S. Overton of Wandin; Mr. Hugh Dettman of Kyneton; Mr. L. K. Daly of Gisborne; Mr. Hancock of Ferntree Gulley; Mr. H. A. Brown of Mount Macedon who has on several occasions been successful in winning the Henry Boyce cup and many other prizes with his seedlings; Mr. Ernest Gibson of Essendon; Mr. O. Ronalds of Tarago; Mr. D. Gunner of Healesville; and Travers Morrison of Wandin. In New South Wales; Dr. Hugh Poate of Sydney and Mr. R. M. Twomey of Albury are also enthusiastic seedling raisers.

In Tasmania the leading growers are Messrs. C. E. Radcliff; S. J. Bisdee; J. R. Byfield; T. D. Raphael; Dr. W. Jackson; W. Jackson, Jr.; and Dr. Drake.

New Zealand growers and their work are not so well known to Australian growers but many fine flowers have been, and are being produced, by Mr. George Lewis of Christchurch, South Island; and Mr. J. T. Gray of Palmerston North; Mr. Alan Gibson of Marton; F. B. Burns of Timaru; and Dr. McKillop of Christchurch.

Regarding the flowers themselves, very few outstanding bi-color trumpets have appeared in recent years. Of these *Oliver* raised by Mr. O. Ronalds is a fine show flower with broad pure white perianth and nicely flanged light yellow trumpet. *Restford* raised by the late Mr. H. Fell is a really good large flower with broad over-lapping creamy white perianth and a shapely yellow trumpet. *Mondo* is also another of Mr. Fell's bi-colors of fine quality and smoothness and solid texture. Of white trumpets *Bridal Day* (Ronalds), *Allan Millikan* (Fell) and several seedlings from *Bersheeba* and *Slemish* have been prominent on the show benches. There is quite a number of good yellow trumpets of which *Ismaris* and *Leslie Fell* (Fell), *Bonnington* and *Robert Montgomery* (Radcliff), *Golden Coin* and *Cloth of Gold* (Ronalds) and *Clio* (Morrison) are all fine exhibition and garden sorts. There is such a plethora of Incomparabilis or short-cupped varieties that it is impossible to mention more than a few of the very best. *Jean Hood* (Plate 293) (D. V. West) is a variety of great merit with white overlapping perianth and beautiful open, red cup with strong stiff stems; *Ivo Fell* (Plate 293) a large round flower of good substance with creamy-white perianth and intense orange-red cup right to the base is an outstanding flower. *Daisy Jean* (Ronalds) is also a good white-perianthed Incomparabilis somewhat similar to *Jean Hood* while *Skylark* by the same raiser is a yellow with broad smooth segments and a large cup of deep orange. *Rubra* (H. A. Brown) is a distinct flower with white perianth and an apricot crown, with an edging of deeper shade.

In the Leedsii section the most remarkable progress has been the appearance of so many pink flowers, that is white petals with pink or pink-edged cups. Mr. Alister Clark has been successful in producing many of these flowers the best of which are *Hugh Dettman* (Plate 292), *Madge Buckland* and *Mabel Taylor*. The greatest advance, however, has been made by Mr. Radcliff of Hobart, Tasmania and his variety *Pink of Dawn* a bi-color trumpet with bluish pink trumpet has been



Hybrid *Incorparabilis* *Narcissus*—**Jean Hood**: raised by the late D. V. West, Casterton, Victoria, Australia: (Inset at lower left) **Ivo Fell**: raised by West & Fell, Casterton.

the grandparent of some outstanding flowers of which *Rosario*, *Kuranja* (Plate 293), *Roslyn* and *Roselip* have aroused admiration whenever shown. *Pink a Dell* (Plate 291) raised by Mr. H. A. Brown of Mount Macedon, Victoria is also a most decorative flower but on first opening the cup is yellow but quickly turns to pink. Last season Mr. Ronalds of Tarago, Gippsland showed for the first time his *Mrs. O. Ronalds* (Plate 292) a really fine show flower with broad overlapping perianth and cap of rosy pink right to the base and a slightly deeper edge. Borne on a strong stiff stem this promises to be an outstanding pink. Several good *Barriis* have made their appearance of which the best is probably *Metaphor* raised by Mr. Alister Clark, while Mr. S. Mann of Ballarat reports a fine flower the result of crossing *Flamenco* and *Rosslare*. Mr. H. A. Brown also has some fine tall flowers of this type but as yet most are under number. There are several nice *N. triandrus* hybrids but little or no work has been done, or is being done, with the *Poeticus* section which seems a great pity as these charming flowers prolong the season well into early summer. While the foregoing notes do not do sufficient justice to the work of Australian and Dominion growers they are sufficient to show that the cult of the Daffodil is firmly established and its prospects for the future extremely bright.

AMARYLLIS CULTURE IN DENMARK, 1940-1945

O. MOHR, *Denmark*

Before the war, as we are again saying, *Amaryllis* were gaining in favor in the minds of the Danish people, and accordingly, florists grew them in increasing numbers. *Amaryllis*, with their distinct, I should say spectacular, flowers are, however, grown profitably only when ample coal supplies are on hand, for the price of the flowers will be high during the winter months, and low in summer. This is a familiar situation in the United States too, I imagine, but the difference in price will be more certain here with dark and cold winter months and with lots of flowers grown outdoors during the summer and fall. We have no Florida or California to ship in flowers cheaply during our winters. Some bulbs are imported, mostly tulips, but very few cut flowers are imported.

Amaryllis, which are easily forced from Christmas until March, fit into this picture just like a glove. They produce their marvelous flowers during the time when prices are high and flowers are few. Without plenty of coal, the picture changes entirely. Our coal supply was cut right after the war broke out, as all contracts were canceled and the price started to climb as soon as new shipments came in. Coal was rationed on the basis of our 1939 consumption, which of course, was small compared to normal for deliveries had stopped on September 2nd (1940). The price of coal jumped from 8 to 40 dollars a ton (buying value) and still could not be found anywhere. With coal supplies cut to about to a third of normal, we had to change our production plan, as

we cut-flower growers all grow something besides *Amaryllis*. We turned to plants that could be grown under cooler conditions in order to stretch out our supplies of coal as much as possible. Some growers kept their *Amaryllis* bulbs, but forced them later, planted them closer together, and some discarded their *Amaryllis* bulbs. I thought that the war was going to last a good many years, and that coal would be very scarce during those years, and accordingly I kept about 15 per cent of my *Amaryllis* bulbs and let the rest go to pieces. The size of the bulbs was around 2 pounds apiece or better—bulbs that all would produce 2—3 spikes each. I regret that I did not carry them through the “cold years.” After the bulbs were thrown out, the houses were



Fig. 153. Hybrid *Amaryllis*; (Left) pink, 10 inch diameter; (Right) dark red, 10½ diameter; both raised by Mohr Bros., Glostrup, Denmark.

planted to tobacco, which was used to manufacture cigars, and later on they were used for tomatoes. This was quite a change from *Amaryllis*. As we grew roses, freesias, tomatoes and orchids, we had lots of trouble in getting through the very cold and dark winters. During these years, we experienced three very cold winters, the coldest on record in 100 years. So we had no desire to go back to *Amaryllis*. The bulbs that we saved were planted outdoors in April and dug in October, thus saving fuel, but of course, only a few flowers were produced. During the winters they were kept dry and were stored away. Of the few that did flower, one especially will be remembered for a very long time. It had a flower not seen before, the kind of a flower all growers dream about

but such as they seldom see. We kept it for three years and decided finally to propagate it by the cuttage method. But alas, all of the divisions were lost because the temperature was too low.

Our trouble was not a growers' trouble alone. During these years, the retailers were not able to heat their shops sufficiently and in consequence the temperature often fell in their windows as low as 32° F. or even below. When they tried to handle *Amaryllis*, they nearly always lost them while carrying them to their shops as their only means of transportation was bicycles and street cars. Bringing the flowers out to the customers in the same way was a sure way of destruction for we experienced the longest and most persistent frosts in our history for three consecutive years. All of this did not encourage the growers to spend what little coal they had been able to save of the winters on *Amaryllis*. It became a matter of life or death for most of our greenhouse plants.

As the years went by, we were able to get some Danish peat to stretch out our coal supplies. The price was shockingly high compared to the American price of 4-5 dollars a ton. On the basis of the B. T. U.'s in coal, we paid as much as 120 dollars a ton for the peat. Even with good prices for flowers this was too much.

With more coal expected in the future, not as yet seen however (1947), we plan to go gradually back to *Amaryllis* again. No doubt, in a few years the fine flowers will once again be seen in the retailers' show windows. The only trouble will be the retailers' inability to handle the flowers with care so as not to bruise the tepals. Although *Amaryllis* cut-flowers are outstanding when in prime condition, they look like a butterfly in the rain when badly knocked-about. We look ahead to the time when the retailers' will learn to buy the flowers before fully open, and thus be able to deliver them in fine shape to their customers.

We also regret that we have been compelled to use all of our seeds for new bulbs, and have not been able to offer any to the trade as we use none but seeds from our finest bulbs. Now again we will be able to dispose of some seeds and bulbs, but it will take another two to three years before we are back to normal again.

1. REGIONAL ACTIVITY AND EXHIBITIONS

VISITS TO GARDENS OF DAYLILY ENTHUSIASTS

ELMER A. CLAAR, *Chairman*

Daylily Committee

My visits in the year 1946 were much more limited than I should have desired.

I did not see any seedlings that were blooming for the first time in Dr. Stout's, Mrs. Nesmith's, and Mr. Plouf's gardens.

It was with a feeling of great personal loss that I heard of Mr. Leonian's untimely death. All who are interested in daylilies owe a great debt to this kindly gentleman. As a result, I did not go to Morgantown, W. Va., in 1946. I also missed Washington. Dr. Traub had been away on a war assignment and had to lay aside his hybridizing work for the time being. I should have liked to have seen Mr. Cooley's and Mr. Shull's hybrids but could not make it in 1946.

I went straight to the New York Botanical Gardens and found that Dr. Stout had moved his newer daylilies from the back of the observatory to the other side of the New York Botanical Gardens, which area is enclosed and under lock and key. Dr. Stout usually doesn't go to the Gardens on Saturday, and, unfortunately, I had to arrive in New York on Saturday. Dr. Stout had made special arrangements to be at the Gardens Saturday morning to see me but my train was so late that he thought I must have missed it and he left before I got there. This was most disappointing to me for the Doctor always has many new seedlings of interest. However, he very kindly left word with his associates to show me the new beds. There were a number of things of interest but most of the plantings were of his named varieties, many of which have been introduced and which I am growing at my home, and some, like *Charmaine*, have been described but are not yet available to the public. There was an alarming amount of destruction by thrips in this planting. I did not see any small seedlings there and later on Dr. Stout wrote that he was growing these at his home, together with his best seedlings. I missed these and so am unable to make a very satisfactory report on this visit.

I am growing Dr. Stout's 1946 introductions, *August Orange*, *Blanche Hooker*, *Caprice*, *Fantasia*, *Georgia* and *Rose Gem*, but as yet I have not seen them in bloom.

Among my favorites of Dr. Stout's daylilies are *Patricia* (a perfect flower form for me but not floriferous,) *Circe*, *Majestic* (a perfect flower color and form but not floriferous and not a good grower,) *Wolof*, *Linda*, *Festival*, *Taruga*, *Wau-Bun*, *Yeldrin*, *Bertrand H. Farr*, *Dominion*, *Cabellero*, and *Port*. *Red Bird* is a beautiful color but two out of three died for me and I have had similar reports as to lack of hardiness

from other growers. *Symphony* is all that I would ask of an intermediate.

From New York I went to Mr. and Mrs. Nesmith's garden at Lowell, Mass., and, as usual, Mrs. Nesmith had a considerable number of interesting things. I ordered and am growing all of her 1946 introductions except one, which was not available, and this year I also purchased *Kilarney Lass* and *Chief Cherokee*, introductions of previous years. The daylily that impressed me the most was Mrs. Nesmith's *Blood Root*, which is a brilliant red, described by some as an orange-red. *Tracery* was exceptionally fine, somewhat like *Twinkle Eye*, a flower which I named. No. 45-23 was a large pink, which I am growing as a guest seedling; 43-52 is a large fluted yellow flower, and 43-35 is another pink that impressed me; 46-113 is an almost black velvety red; *Daily Double*, a Geddes Douglas introduction, is a double yellow, the first double seedling that I have seen introduced. *Moonlight Cocktail*, another Douglas seedling introduced by Mrs. Nesmith, is a good yellow.

Among my favorite daylilies of Mrs. Nesmith's are *Royal Ruby*, *Honey Red Head*, *Black Falcon*, *Canari*, *Sweet Briar*, *Petra*, *Dawn Play*, *Pink Charm*, *Heather Rose*, *Su-Lin*, *Gay Troubador*, *Bold Courtier*, *Royalty*, and *Potentate*.

From Lowell, after a pleasant stay with Mr. and Mrs. Nesmith, I went over to Mr. Ernest Plouf's, at Lawrence, Mass. Mr. Plouf informed me that he had been away in the service for several years. Since I last visited his garden he has moved it out to the country. He has not had an opportunity to have any new seedlings. Several of his named varieties were very interesting. I was especially impressed with a pink that he has named *Pink Flamingo*. It looks like a self. *Algerian Sortie* is pinkish, large, and fuller than *Pink Flamingo*, but I did not like it so well. His reddish red, a very good one, was *Desert Sunset*. Mr. Plouf also had some late George Yeld introductions that he had secured from Mr. Yeld's daughter. One he named *Holildred Yeld*. This flower did not impress me. His *Vipart* is a large and odd shaped salmon color. *Creamore Ruby* continues to be one of the most brilliant reds.

One of the greatest thrills that a hybridizer can have is to go through the gardens of other hybridizers looking for something new. On one of our trips to Dr. Kraus' gardens at Wychwood, Lake Geneva, Wisconsin, last year, we went to his fields, located about two miles from Wychwood. The Doctor had used some oats straw in these fields to protect his seedlings during the winter. Unfortunately, all the seed had not been shaken out of the straw and his seedlings were having one terrific battle with the oats! Dr. Kraus has thousands of seedlings at Lake Geneva and at the University of Chicago, and among these are some beautiful velvety deep reds. The most outstanding of them in my opinion, and it also is the choice of Dr. Kraus, is No. 952, which, through the generosity of Dr. Kraus, I am growing. There are bigger reds but I know of no other so velvety. No. 2060 is a lovely cherry red; 1952 a crimson that Dr. Kraus liked better than any of the other reds (952 was

not out that day). I have crossed 952 with many other fine plants and hope to have seedlings from this plant in the near future.

Dr. Kraus' oldest named variety is *Joanna Hutchins*, which is a very much improved *Majestic*. The flower is very similar to that of *Majestic* but the plant is much better. It is floriferous and a good grower. A seedling that impressed me very much was an eyed pattern, No. 2284, a sister seedling, I believe, to No. 2050. Both resemble the favorite *Mikado*, but with better color, much better substance and a more contrasting eye. He also had a lovely raspberry colored seedling, No. 2084. On July 20, when I saw it, it was big and overlapping and very much worth while.

The seedling that impressed me as being the most desirable that I have seen in the last two years was a light pinkish lavender or orchid flower which I found in the field. It was a cross of Dr. Kraus' seedlings 595 x 471. He took the plant to the University of Chicago planting grounds and numbered it 1986. A considerable stir was created that day by a seedling, 471 x 424, which was variously described as a melon or straw color, and which also was removed to the University of Chicago gardens, and numbered 2001. As I had seen a seedling of somewhat similar color in Dr. Traub's garden at Beltsville a few years ago, I was not so impressed. Dr. Kraus also had an orange flower in this seedling bed which had a very fine color and which was further distinguished by the fact that it was a double. It was a cross of *Tawny* and *Regal Lady*. He also had in these same fields an interesting pink-rose seedling.

Dr. Kraus has been working on a series of miniature daylilies, with some very interesting results. They are comparable to the table iris. Among these are his seedling 2633, the flower of which is only 3" across, a gold colored daylily; 2322, a 2½" yellow; 2403, a dull rose or raspberry; 2096, a very bright red; 2740, a yellow, the scape of which is about 18" high, the flower star shaped and twisted, with an interesting pattern; and 2785, a very small dark red. I liked these very much for I have been working on this type of hybrid myself.

Dr. Kraus said that his favorite seedling is 852, a floriferous flower (it had 15 flowers the day I saw it). It has sulphur colored sepals, a wide dark eye, and a star shaped flower that is overlapping. I saw many others of his seedlings that I would rather have.

Chicago and vicinity are becoming a real daylily center. Among the individuals who are hybridizing are Mr. Orville Fay and Mr. Dave Hall of Wilmette, and Mr. Hubert Fischer of Hinsdale, President of the Men's Garden Club of the Chicago Region.

Dave Hall is very enthusiastic about his *Mission Bells*. It certainly is one of the most floriferous daylilies that are grown but I like *Mongol* better. Among his seedlings that I like best are his 46-13, a very luminous dark red, which I believe to be outstanding, and 46-17, a dark red which is distinguished by being very overlapping. No. 43-12 is a great favorite of Mr. Hall's. It is very similar in color to *Canari* and *Vespers*, but in each of these the color of the throat is the same as that of the sepals, whereas Mr. Hall's seedling has a green throat. It is

more overlapping and delightfully ruffled. The anther on Mr. Hall's seedling is white, whereas the anther on *Vespers* is black.

I secured this year from Mr. Robert Schreiner *Judge Orr* and Clint McDade's *Jean*.

From Midwest Gardens I secured *Orange Beauty* and No. 64-41, which Mr. Sass said he may name *Midwest Star*. The Sass yellow and orange daylilies are outstanding. *Hesperus*, *Nebraska*, Seedling 45-40, *Sunny West*, *Star of Gold*, *Revolute* and *Orange Lady* are all good.

From Mr. Russell I obtained:

<i>Meteor</i>	<i>Lillian Russell</i>	<i>Purple Waters</i>
<i>Monte</i>	<i>Trail Blazer</i>	<i>On Tour</i>
<i>Betty Slick</i>	<i>Guest Star</i>	<i>Francis Russell</i>
<i>Black Hills</i>	<i>Quote Me</i>	<i>Pat Fleming</i>
<i>Edith Russell</i>	<i>Purple Sage</i>	<i>Miss Houston</i>

Mr. Russell is an enthusiastic daylily hybridizer. I was in San Antonio, Texas, two years ago, on my way back from Mexico, and called him on the phone but it was too early for his blooming season so I did not go out to his garden. However, he has been at my home each year for the past several years and each time he has been loaded with enthusiasm and Kodachrome transparency pictures of his garden, introductions and seedlings. His pictures of over nine acres of daylilies are truly an impressive sight. So far as I know he is the only one who makes his living solely with daylilies.

I, personally, tremendously like Mr. Russell's *Painted Lady*. It has been so popular that he said it will not be available again for sale for a number of years. *Betty Slick* is a nice bicolor and *Trail Blazer* is outstanding among the darker types. His *Tejas* is a small but very brilliant red flower. I have seen nothing in the intermediate blooming varieties that equals his *Queen of Gonzales*. Russell's *Sylvia* is a bigger and better *Linda*. The eye is more contrasting and it has a better stem and flower. This is genuine praise because *Linda* is one of the daylilies that Mrs. Claar likes best. *Spit Fire* is brilliant. His *Miss Houston* is a superior pink. I cannot be enthusiastic about his *Annis Victoria Russell*. It is large but spidery, as I grow it. I like overlapping flowers.

Another enthusiast who certainly is going places is Mr. Ralph Wheeler of Winter Park, Florida. Some years ago he sent me a large number of hybrids, among them *Duncan*, *Easter Morn*, and *Bobolink*, an overlapping and brilliantly contrasting bicolor, which did not bloom for me last year. His *Ruby Supreme* takes time to produce a typical plant. It is a fine flower, very floriferous and worthy of the best of company. I cannot get any seedlings from it or by its pollen. I certainly made a great many crosses. Mr. Wheeler sent me a number of Kodachrome transparencies this winter and if one can rely on these pictures he apparently is at the head of the parade in anything I have seen in bicolours. He also apparently is developing some whitish tinged lilac flowers which are most noteworthy. Prof. Saxton is introducing Mr. Wheeler's plants and I predict a great demand for them.

Mrs. Claar and I are going to Jamaica this winter and when we come back if Mr. Wheeler's and Mr. Hayward's flowers are in bloom, we shall stop off at Winter Park to see them. I have not heard from Mr. Hayward for some time. His name of "*Salmon Rose*" is a perfect description of a lovely flower. His *Minnie* is a variable flower as I grow it—one time it is very superior and at other times it is not at all impressive. His *Emperor Jones*, *Araby* and *Irene* are tops.

Among Dr. Traub's flowers that I wish to emphasize as being among my favorites are *General MacArthur*, *Lidice*, *Mayor Starzynski*, *Indian Chief*, and *Dr. Stout*.

Dr. Norton's *Mongol* is my favorite yellow. It is a high flower, has a clean, clear color and is a fine plant. His *Garden Lady* is a fine bi-color.

I believe Dr. Shull's *Gorgio* and *Musette* are his best introductions.

I like Prof. Watkins' *Kanapaha* and *The Swan*.

Mr. Betscher's *Anna Betscher*, *Earliana* and *Gloriana* still are favorites.

Port Rose Garden's *Olive* and *Old Ivory* are worth while.

I have not seen any of Mr. Bechtold's seedlings. Gilbert H. Wild & Son are introducing them.

I have not seen any of Mr. Milliken's seedlings.

The Hills of Lafontaine, Kansas, are introducing their first seedling this year, *Redwood*, but I have not seen it.

Mrs. Dewey's *Enchantress* has not received the notice it deserves.

Mr. W. T. Wood's *Neon* is very good. It will be very popular when it becomes widely distributed.

Perry's *George Yeld*, *Sir Chandre*, *Mabel Hibberson* and *Flavia* are good in my garden.

Wyman's *Red Sox* is brilliant.

This summary of what I saw and liked necessarily must be limited to my own observations and tastes. My conclusion is that all of the hybridizers are getting excellent results.

I moved most of my flowers, including my seedlings, in the fall of 1945 to my new home at 617 Thornwood Lane, Northfield, Illinois. I have had over 10,000 daylily seedlings since I started hybridizing, ten years ago. I had about 4,000 last year, some of which will bloom this year. I have been thrilled with some of my seedlings. Among them is a flower that looks exactly like *Patricia* but it comes considerably earlier; however, it has the weakness of *Patricia* in that it is not floriferous. I have some fair pink, rose and red flowers but I shall not attempt to give any detailed descriptions of them until I see them in bloom some more.

THE AMARYLLID ROUND ROBINS

EDITH B. STROUT,
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In September, 1941, in the Club and Society page of the Flower Grower Magazine, Miss Marion P. Thomas told of a Round Robin Begonia Club, where all the "meetings" were conducted by correspondence. It was suggested that other round "robins" be formed on other subjects with the idea of bringing together, by letters, people of kindred tastes who liked to exchange information about their chosen topic. The idea caught on like wild fire and soon "robins" were formed on many subjects, with members from coast to coast.

The rules are very simple. Any reader of the magazine is eligible. Each subject has a "mother," with directors for each "robin," who lays out a route so the letters will take the shortest possible time from member to member. All letters are sent first class mail, and each member keeps the letters for a limited time of 4 or 5 days. When the letters are mailed to the next member, a card is also sent to the leader so that he may know just where the "robin" is at any time. It takes about two and a half to three months for the letters to make the rounds. A letter starts on its way with questions, problems to be settled, and other information; possibly seeds or photos inclosed. Each member adds to this, answering questions asked or seeking information for himself.

Some people feel that because they are beginners, they are not eligible for membership but such is not the case. All are in the "robins" to learn more about their pet hobby, and those who know the most help the ones who know the least. The beginners may have to start asking questions, but this merely gives the more experienced ones an opportunity to pass on what they have already learned.

The *Amaryllis* "Round Robins" were started in March of 1943 under the able directorship of Mrs. A. W. Knock of Minneapolis, Minn., and I was fortunate enough to join at this time also. Hybrid *Amaryllis* were our principal interest, but it was soon evident that many of the members grew other bulbs of the *Amaryllidaceae*.

Many of the members live in small communities and are often the only ones there interested in amaryllids, so the opportunity to "chat" with a kindred soul has been most welcome. I have found it very inspiring to compare my method of plant culture with that of other members, and I gathered much information on how to get certain bulbs to bloom, what to do for certain pests, best time to transplant, etc. The whole group has profited by the errors of others, as well as by their successes.

A good many of the members of the *Amaryllis* "Robins" are members of the American Plant Life Society. As some have never heard of it and its fine publication HERBERTIA when they join the *Amaryllis* "robins," the loan of a copy of HERBERTIA makes them so enthusiastic that they also join the Society.

Since *Amaryllis* is a very popular subject, our membership has grown until now we have twelve *Amaryllis* "Round Robins," each with ten members, and more forming all the time. Due to lack of time, Mrs. Knock had to resign as "mother" of them and the writer felt very honored when asked to take over as such. Since all of the directors of the *Amaryllis* "Round Robins" are also members of our No. 1 group, we keep in close touch with one another.

And of course, there has been a bit of friendly competition in the clubs to see who could get her seedlings to bloom first.

Most of the members, like myself, are people of modest means, and though ardent plant lovers, the cost of rare amaryllids is often beyond our limited funds. But seeds of our best flowers have been freely exchanged through the "robins" and there has also been a great deal of exchanging of offsets.

At first this may seem to be doing the commercial nurserymen out of their business, but such is not the case. In some instances, the member never would have been able to afford the price of some rare flower, but does have the patience to grow them from seed and eventually enjoy their great beauty. Other times, the descriptions of such items as *Lycoris*, *Hymenocallis*, *Haemanthus*, etc. have been so glowing and aroused so much interest, that members did not want to wait for seedlings, but sat down immediately and sent in an order to some commercial nurseryman.

Interest is at such a high pitch that members' plant collections have increased by leaps and bounds.

Also by comparing photos and descriptions, quality of the bloom of our plants is compared and judged. Many inferior hybrid *Amaryllis* are being discarded to be replaced by better types. Most of us do a little amateur hybridizing too, our best seed being shared with other members.

And sometimes seeds are sent around of plants that are not listed by any commercial grower. For example, Dr. Traub sent me a seedling of an *Agapanthus* species. When this bloomed for me, I sent seed around in the "robins" so eventually this fine plant will be bringing joy to many avid amaryllid fans across the country. Since species *Amaryllis* are my special pets, I've been able to send around seeds, or seedlings, of *Amaryllis vittata* too, and when other *Amaryllis* species bloom, hope to be able to distribute these as well and share my good fortune with others. In fact, like many of the other members, I seldom have two plants of anything, for as soon as they multiply, offsets are sent to friends. And many very fine things have likewise come my way, and I have profited thereby immensely.

The group of "robins" has done considerable to increase the general public's interest in amaryllids, for naturally, when a fine plant blooms, we call in our neighbors to view it, as well as display our choice plants in local flower shows. Soon the whole neighborhood gets interested in the various members of this fine family of bulbs. As an example, when I moved into my neighborhood three years ago, the only amaryllids anyone was acquainted with were *Narcissus*. Now, after hearing me

rave about my plants, and seeing some of them in bloom, one of my neighbors has some representative of all the amaryllids listed in the growers catalogs! And I know that this same thing has been duplicated in many sections of the country, wherever our enthusiastic "robin" members reside.

The group is always eager to learn, and books and magazine clippings are circulated. We have joined one of the botanical societies and share the publications, and are always on the lookout for anything that would further increase our knowledge of the *Amaryllidaceae*. We are also on the lookout for any rare amaryllids from foreign countries, in hopes of introducing them to the members; which eventually means to the whole U. S. for our members live in many different sections of the country. In fact, our clubs make a good "Trial Garden" themselves, with the various climatic conditions of Maine and Minnesota to Florida, Texas, California and all the way in between!

But one of the most enjoyable profits from the clubs is the many fine friendships formed. Although I have not met any of the members personally, the friendships made have brought me more enduring pleasure than my lovely flowers.

THE MIDWEST HEMEROCALLIS SOCIETY

MRS. OLGA ROLF TIEMANN

In order to discuss Daylilies, a number of amateur gardeners who had discovered the true value of the new and improved forms of *Hemerocallis* joined together in "Round Robin" letter groups inspired by Helen Field Fischer's "Garden Club of the Air" program (KFNF, Shenandoah, Iowa) and Flower Grower "Round Robin" clubs.

To reach an even larger group, a society dedicated to *Hemerocallis* seemed desirable. This new society, the Midwest Hemerocallis Society, was organized by a group of enthusiastic daylily fans at a meeting sponsored by the Henry Field Seed Company at Shenandoah, Iowa, on July 13 and 14, 1946. Since then, many hybridizers, commercial growers and amateur gardeners have joined. The membership is over 400 now, representing all but 12 states. There are also members from Canada.

The society is a very enthusiastic group. Their first yearbook is on the press (January, 1947) and promises to be very worthwhile with pictures and articles on many phases of *Hemerocallis* culture by amateurs and experts. It will contain names and addresses of all members, list of literature in its lending library, sources of plants and other subjects of interest to *Hemerocallis* lovers.

Membership is still open. Send dues, three dollars, to the treasurer, Frederick Fischer, Box 5, Shenandoah, Iowa.

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND
PHYLOGENY]

ON THE KARYO-SYSTEMATICS OF THE SUB-GENUS AJAX SPACH OF THE GENUS NARCISSUS L.

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Institut Botanique de l'Université de Coimbra, Portugal

[Translated from the French into English by Thomas W. Whitaker.]

INTRODUCTION

The history of the taxonomy of the group *Ajax* Spach of the genus *Narcissus* L. has been recorded in a very satisfactory fashion by Pugsley (1933). According to this author, we learn that the number of species attributed to this group varies a great deal, and that this variation has been due not only to the different numbers of forms known during a certain epoch, but also to differences of opinion among authors concerning the delimitation of specific groups. Thus Linné (1753), in the first edition of the "Species Plantarum," distinguished only one species. Later (1762), in the second edition of the same work, he distinguished two. Salisbury (1812) distinguished 10, Haworth (1831) 29, Herbert (1837) 9, Barr (1884) 8, Baker (1888) one, with 6 sub-species and one variety, and Jordan (1903) 13. Rugsley (1933) finally established two.

Cytological studies in this group have been made by de Mol (1922, 1928), Nagao (1929, 1930, 1933), Fernandes (1931, 1933, 1934), Collins (1933), Philip (1933, 1934) and Sikka (1940). However, in spite of these studies, we can state that we do not yet know the idiograms¹ of these species, since the morphology of the chromosomes has not been studied in detail. Accordingly, having procured material of a great many forms, we have resolved to establish their idiograms with the aim of illuminating the following two questions: (1) Can the data concerning the number and morphology of the somatic chromosomes be of aid in resolving the problem of the delimitation of species?; (2) What are the processes that have been active in the evolution of this group?

Apart from the forms corresponding to the wild species distinguished by Pugsley (1933), we are also presenting in this study, the results of our observations on the cytology of some forms obtained in cultivation, whose origin we have tried to clear up.

¹ [Translator's note. According to Sharp, (Introduction to Cytology) **idiogram** is defined as the diagrammatic representation of a karyotype. **Karyotype** is the chromosome complement characteristic of an individual or group of allied forms.]

MATERIALS AND TECHNIQUE

Some plants have been collected in Portugal in the wild state, others have been furnished by Botanical Gardens, and still others by Maison Barr & Sons², Reginald Kaye, Cayeux-LeClerc & C.ie, Vilmorin-Andrieux & C.ie and Fernandes Coimbra, Valardares (Gaia).

The following list indicates the name of the forms³, as well as their origin :

<i>N. cyclamineus</i> DC.	bed, left bank of the Ferreira River, (fig. 154) near Pôrto.
<i>N. Johnstonii</i> Pugsley	Fernandes Coimbra.
<i>N. Johnstonii</i> Pugsley (<i>N. Queen of Spain</i>)	Barr & Sons.
<i>N. asturiensis</i> (Jord.) Pugsley	Serra da Estrêla.
<i>N. minor</i> L. (<i>nanus</i>)	Barr & Sons; Reginald Kaye.
<i>N. pumilus</i> Salisb. (<i>minor</i>)	Barr & Sons.
<i>N. nanus</i> Spach (<i>lobularis</i>)	Barr & Sons.
<i>N. hispanicus</i> Gouan (<i>maximus superbus</i>)....	Barr & Sons.
<i>N. obvallaris</i> Salisb. (<i>obvallaris</i>)	Barr & Sons.
<i>N. portensis</i> Pugsley? (<i>N. Pseudo-Narcissus</i> L. var. <i>concolor</i> in Coutinho, Flora of Portugal)	Origin uncertain; collected in the wild and cultivated in the Coimbra Botanical Garden.
<i>N. pseudo-narcissus</i> L. (Lent Lily)	Barr & Sons.
<i>N. pseudo-narcissus</i> L.?	Leca do Bailio.
<i>N. Gayi</i> (Hénon) Pugsley (<i>Princeps Maximus</i>)	Barr & Sons.
<i>N. moschatus</i> L. (<i>cernuus</i>)	Barr & Sons.
<i>N. tortuosus</i> Haworth (<i>N. longiflorus</i> Willd.)	Hortus Botanicus Petropolitano in Leningrad.
<i>N. pseudo-narcissus</i> L. var. <i>bicolor</i> (L.), in Coutinho, Flora of Portugal	Serra da Estrêla.
<i>N. pseudo-narcissus</i> L. (double flowered)....	Avelar.
<i>N. yellow double</i> Van Sion	Vilmorin-Andrieux & C.ie
<i>N. trumpet</i> Impératrice	Vilmorin-Andrieux & C.ie

² We are greatly indebted to Maison Barr & Sons, London, who have furnished us bulbs of the forms we have requested.

³ We are extremely thankful to M. H. W. Pugsley, who has communicated to us the equivalence between the names in the Catalogue of Maison Barr & Sons, and those species he has established in his monograph.

N. trumpet Emperor	Cayeux-LeClerc & C.ie
N. trumpet Major	Cayeux-LeClerc & C.ie
N. trumpet, King of the yellows	Vilmorin-Andrieux & C.ie
N. trumpet, M.me de Graff	Cayeux-LeClerc & C.ie
N. King Alfred	Fernandes Coimbra.



Fig. 154. *N. cyclamineus* DC. in its classic locality near Pôrto (bed, left bank of the Ferreira River). Dr. A. Rozeira photo.

Our observations have been carried out principally with root meristems. In only one case have we studied the first division of the nucleus in the pollen grains (*N. pseudo-narcissus* L. var. *concolor*), and meiosis has been studied in *N. hispanicus* (Maximus superbus) and *N. Johnstonii*). For obtaining preparations of root meristems, we have used Navashin's fluid, (Brumm's modification) and staining with gentain violet.

For the study of meiosis, in the pollen mother cells, we have utilized two types of preparations:

(a) Preparations obtained by fixation with La Cour 2BE and stained with gentian violet.

(b) Preparations obtained by fixation in acetic-alcohol (3 parts absolute alcohol: 1 part crystalizable acetic-acid) and stained in aceto-carmine. These preparations have been made permanent by employing the technique described by La Cour (1937).

Mitosis in the pollen grains has been studied in non-permanent preparations, obtained by the maceration of anthers in a drop of aceto-carmine.

OBSERVATIONS

By examination of the equatorial plates in the cells of the root meristems we have established the existence of 14 chromosomes in the following forms: *N. cyclamineus* DC., *N. asturiensis* (Jord.) Pugsley, *N. minor* L., *N. pumilus* Salisb., *N. nanus* Spach, *N. obvallaris* Salisb., *N. portensis* Pugsley? (*N. pseudo-narcissus* L. var. *concolor* in Coutinho, Flora of Portugal), *N. pseudo-narcissus* L., *N. Gayi* (Hénon) Pugsley,

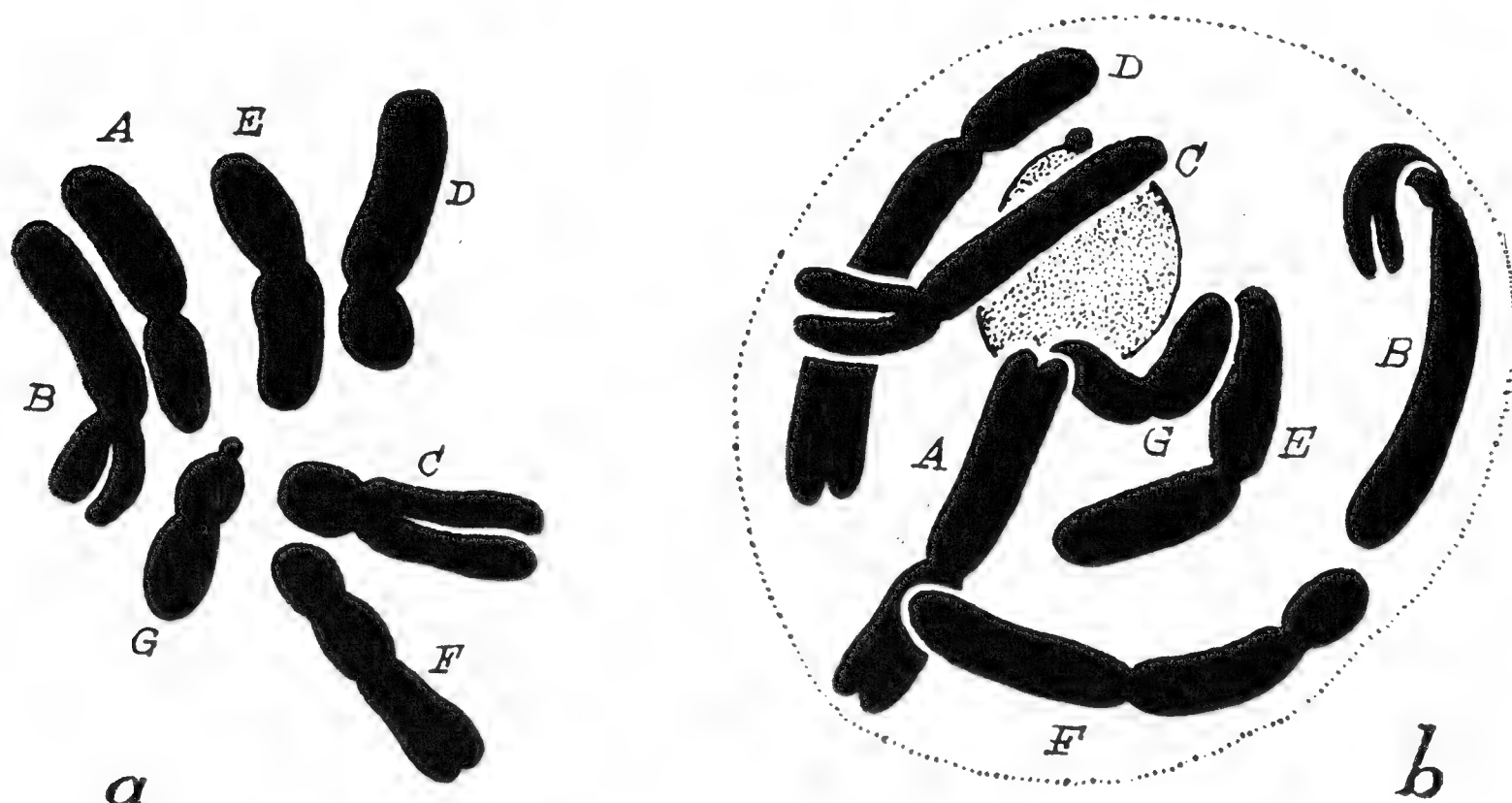


Fig. 155. *N. pseudo-narcissus* L. var. *concolor* (Coutinho, Flora of Portugal). *a*, Equatorial plate of the first division in the pollen grain; the chromosomes are marked by the letters A - G. *b*, Pro-phase of the same division; note chromosome G attached to the nucleolus by its satellite, X 2200.

N. moschatus L., *N. yellow double* Van Sion, *N. double flower* of Avelar, *N. trumpet major* and *N. trumpet*, King of the yellows.

An analysis of metaphase in the first division of the nucleus in the pollen mother cells has permitted us to identify the following 7 types of chromosomes (fig. 155a):

- A—heterobrachial chromosome li;
- B—heterobrachial chromosome Lm;
- C—Chromosome similar to the preceding type, but with the long arm slightly shorter;
- D—Chromosome Lp, resembles the two preceding types but with the short arm less than half the length of the longer one;
- E—Chromosome li similar to type A, but the two arms are shorter and the secondary constriction is located near the extremity of the long arm;
- F—Chromosome Lp similar to type D, but short arm not as long; a submedian constriction on the arm L has been observed in a majority of the figures;
- G—Satellited chromosome Pp'. This chromosome is the only nucleolar one, as indicated in prophase figures, in which this chromosome and its satellite is found attached to the nucleolus (fig. 155b).

In the diploid plates of all the forms mentioned above (Plate 294, fig. 156, 157, 158a and 159a), we have established the existence of 7 pairs of homologues, corresponding to the types described for the pollen grains. We have never found differences between elements of a pair which might indicate structural hybridity. So that, we can say that all these forms possess the same idiogram, expressed by the general formula:

$$2n = 14 = 4 : Lm + 4 : Lp + 4 : li + 2 : Pp'$$

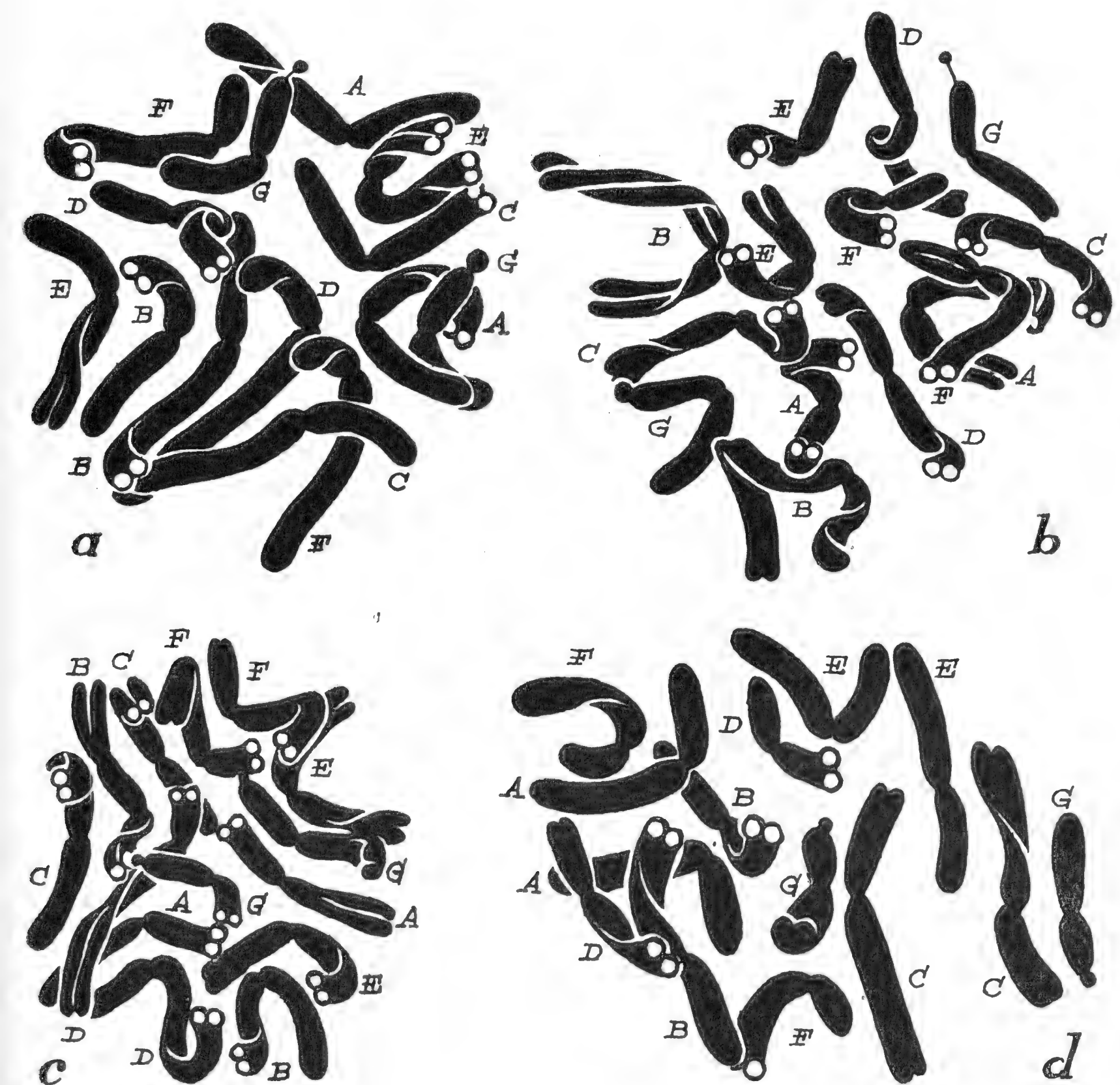


Fig. 156. Equatorial plates from the cells of the root meristem. *a, b*, *N. pseudonarcissus* L. (Lent Lily). *c*, *N. Gayi* (Hénon) Pugsley. *d*, *N. moschatus* L. The chromosome pairs are indicated by the letters A - G. X 3250.

In the root meristem of *N. minor*, we have found, apart from the normal diploid plates (fig. 158a), some plates having 28 chromosomes (fig. 158a). This is a question of mixoploidy, a well known phenomenon, and one which has already been described by Fernandes (1936) with another species of the genus (*N. reflexus* Brot.).

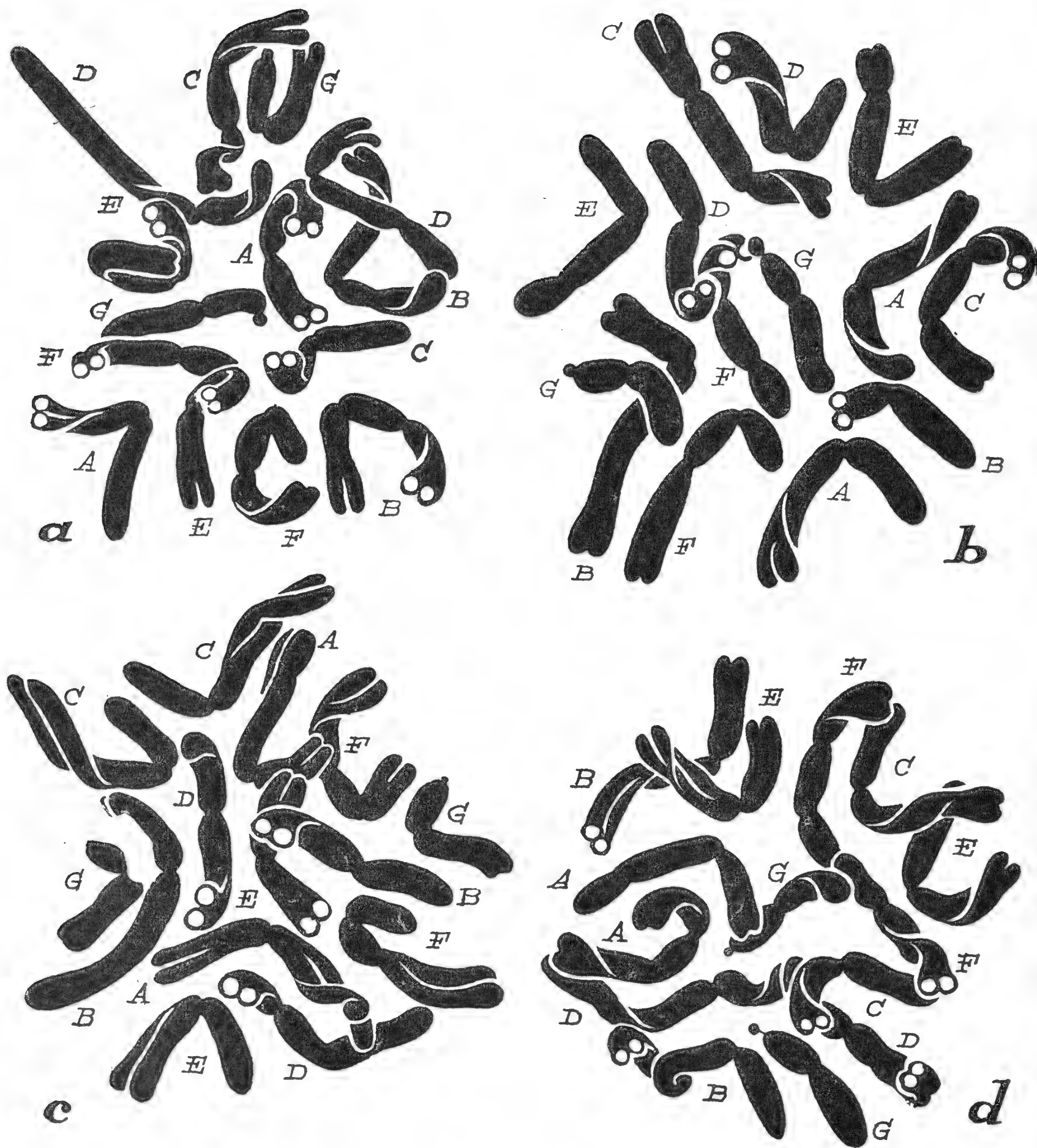


Fig. 157. Equatorial plates from the cells of the root meristem. *a*, *N. pseudo-narcissus* L. (Avelar). *b*, *N. yellow double Van Sion*. *c*, *N. trumpet major*. *d*, *N. trumpet King of the yellows*. The chromosome pairs are indicated by the letters A - G. X 3250.

Plate 294. (See opposite page for plate.) Equatorial plates from the cells of the root meristems: *a*, *N. cyclamineus* DC. *b*, *N. pumilus* Salisb. *c*, *N. nanus* Spach; note that the G chromosomes carry a "tandem satellite." *d*, *N. obvallaris* Salisb. *e*, *N. portensis* Pugsl.? (*N. pseudo-narcissus* L. var. *concolor*). *f*, *N. pseudo-narcissus* L. (Leca do Bailio). The chromosome pairs are indicated by the letters A - G. X 3250.

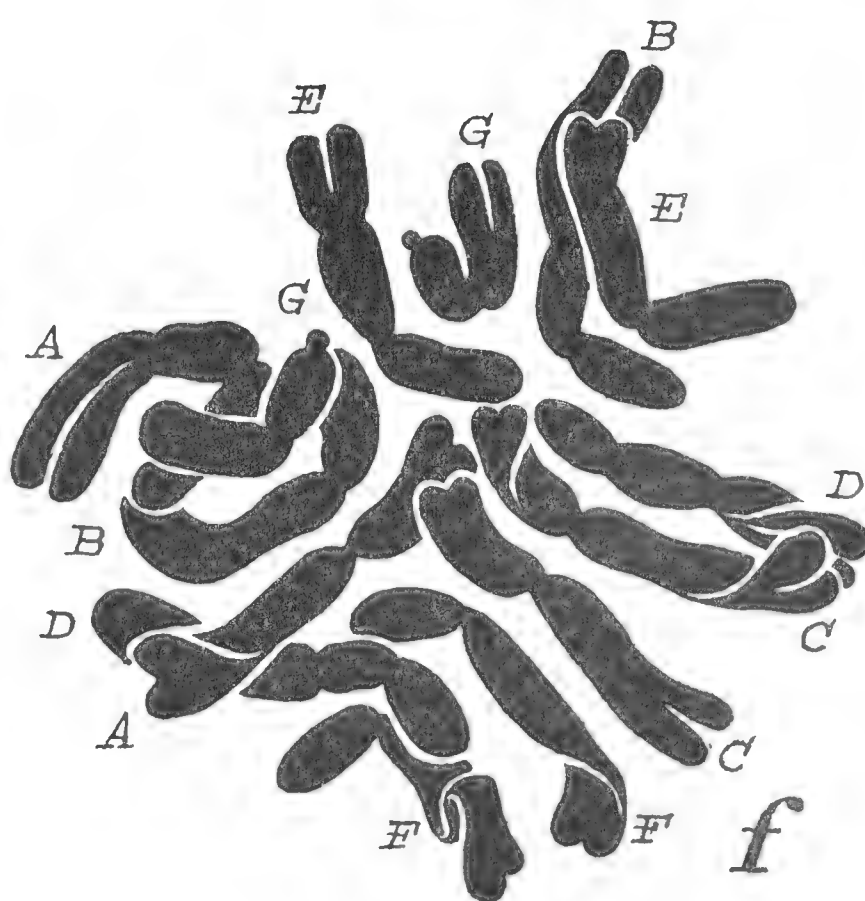
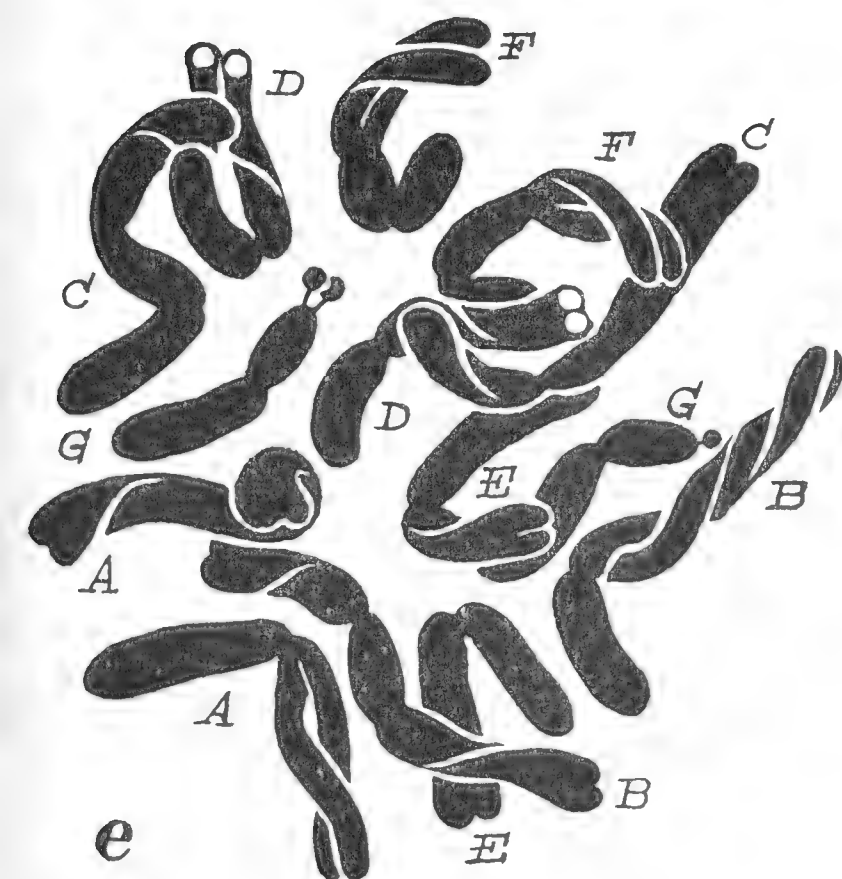
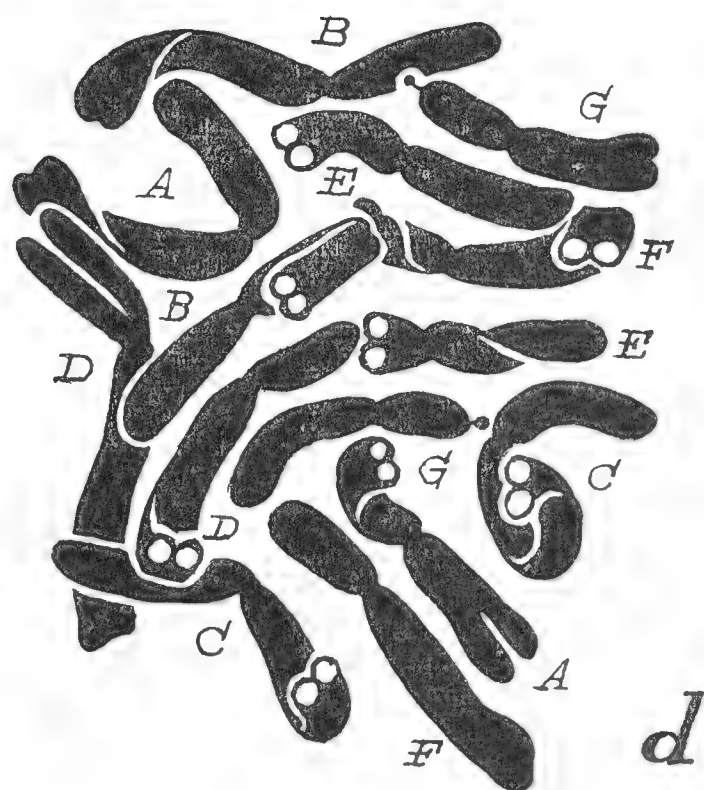
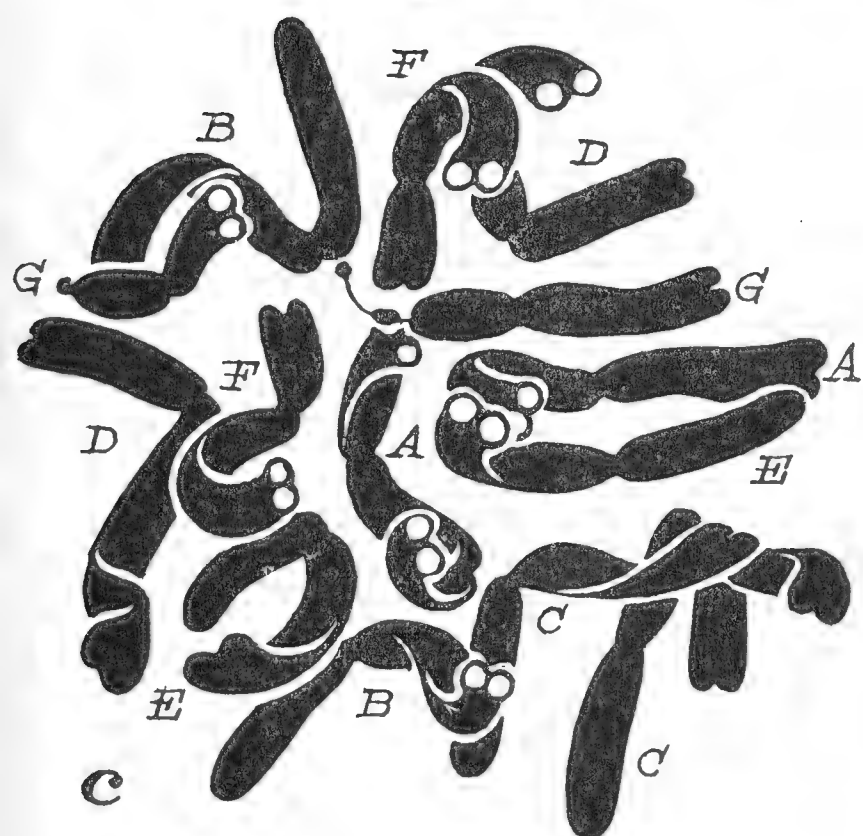
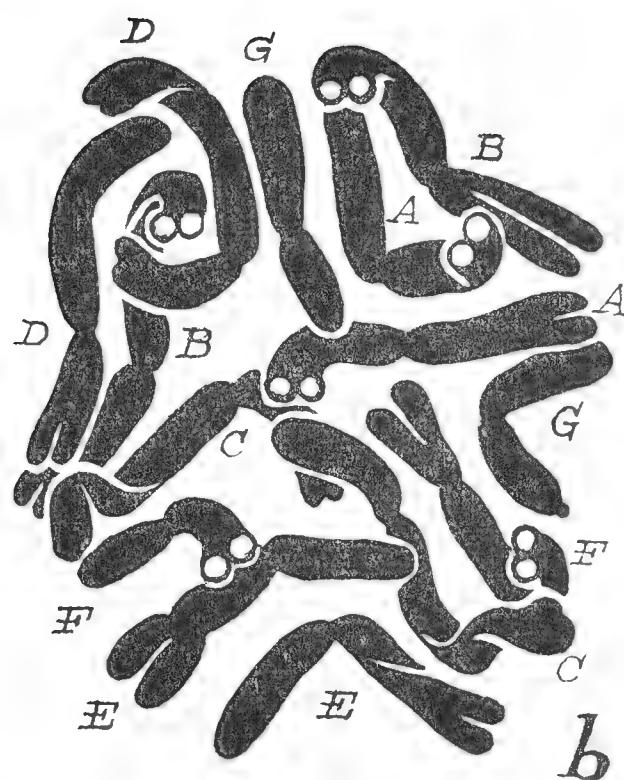
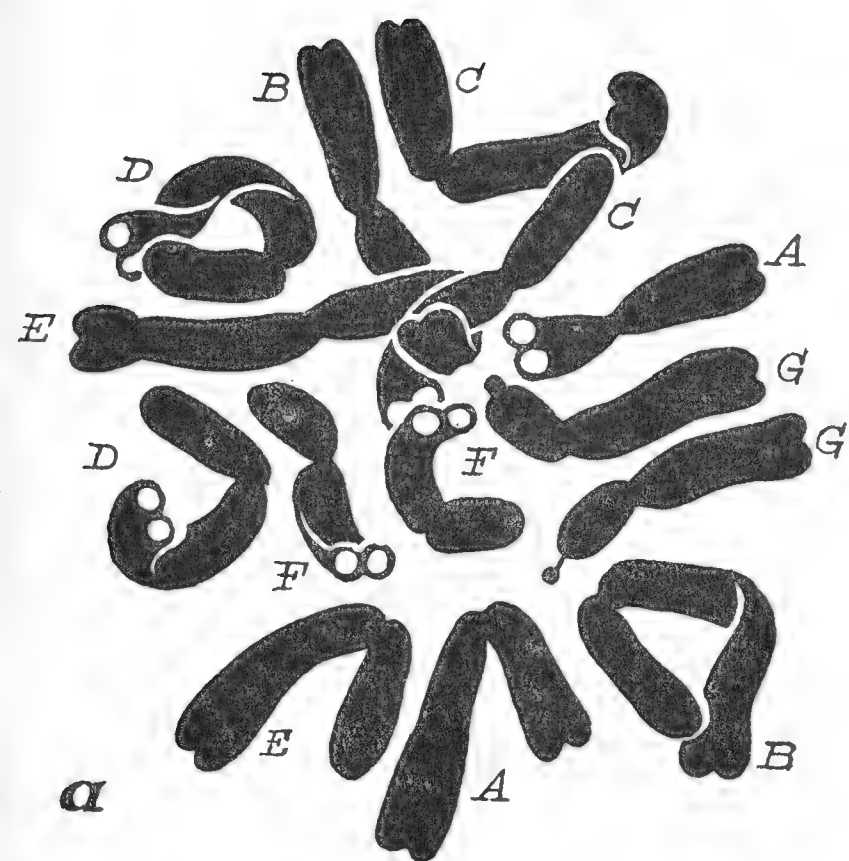


Plate 294 (see opposite page for details.)

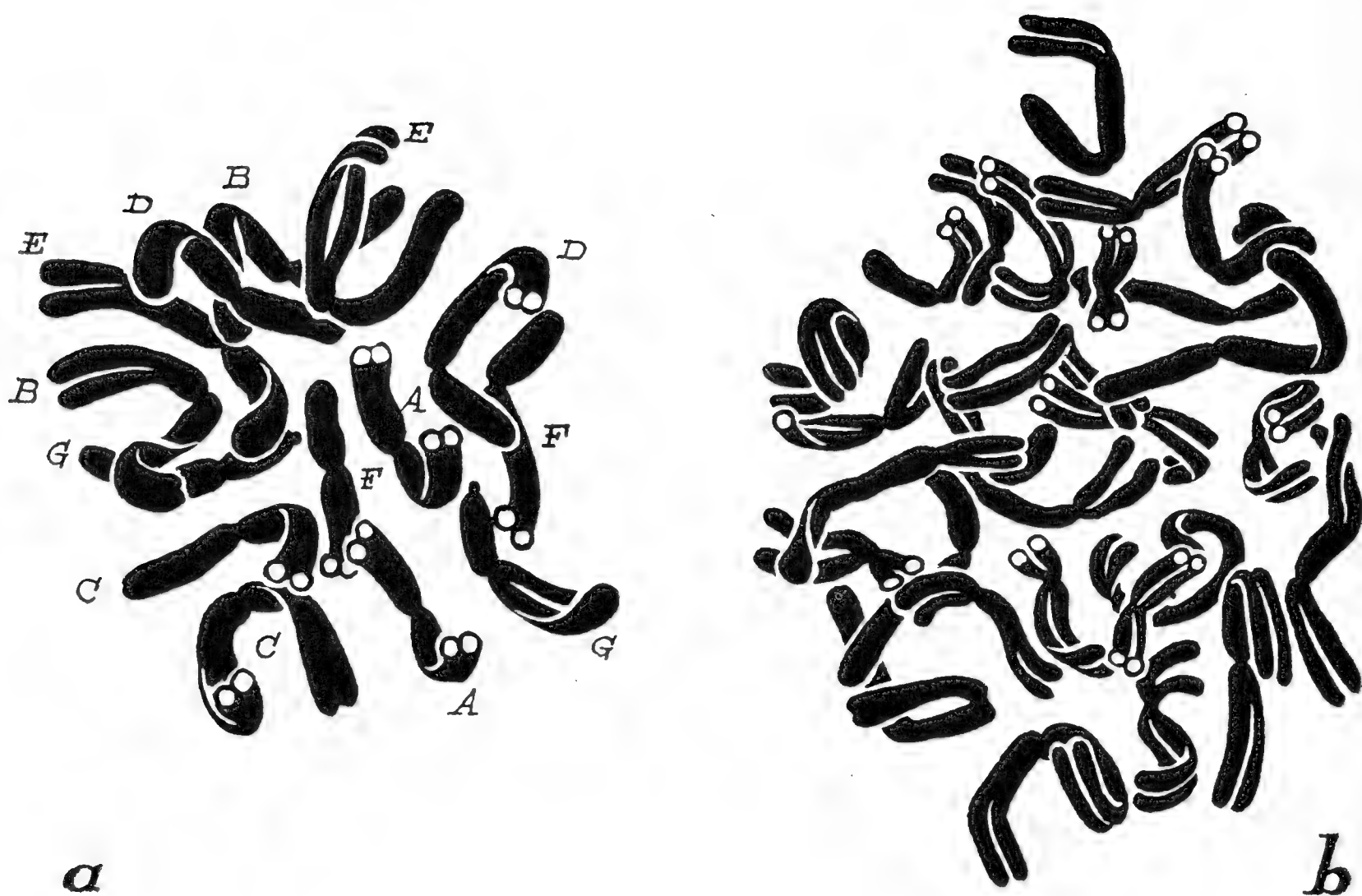


Fig. 158. *N. minor* L. *a*, Equatorial plate in the diploid cells of the root meristems. *b*, Tetraploid plate in another cell of the same root. X 3250.

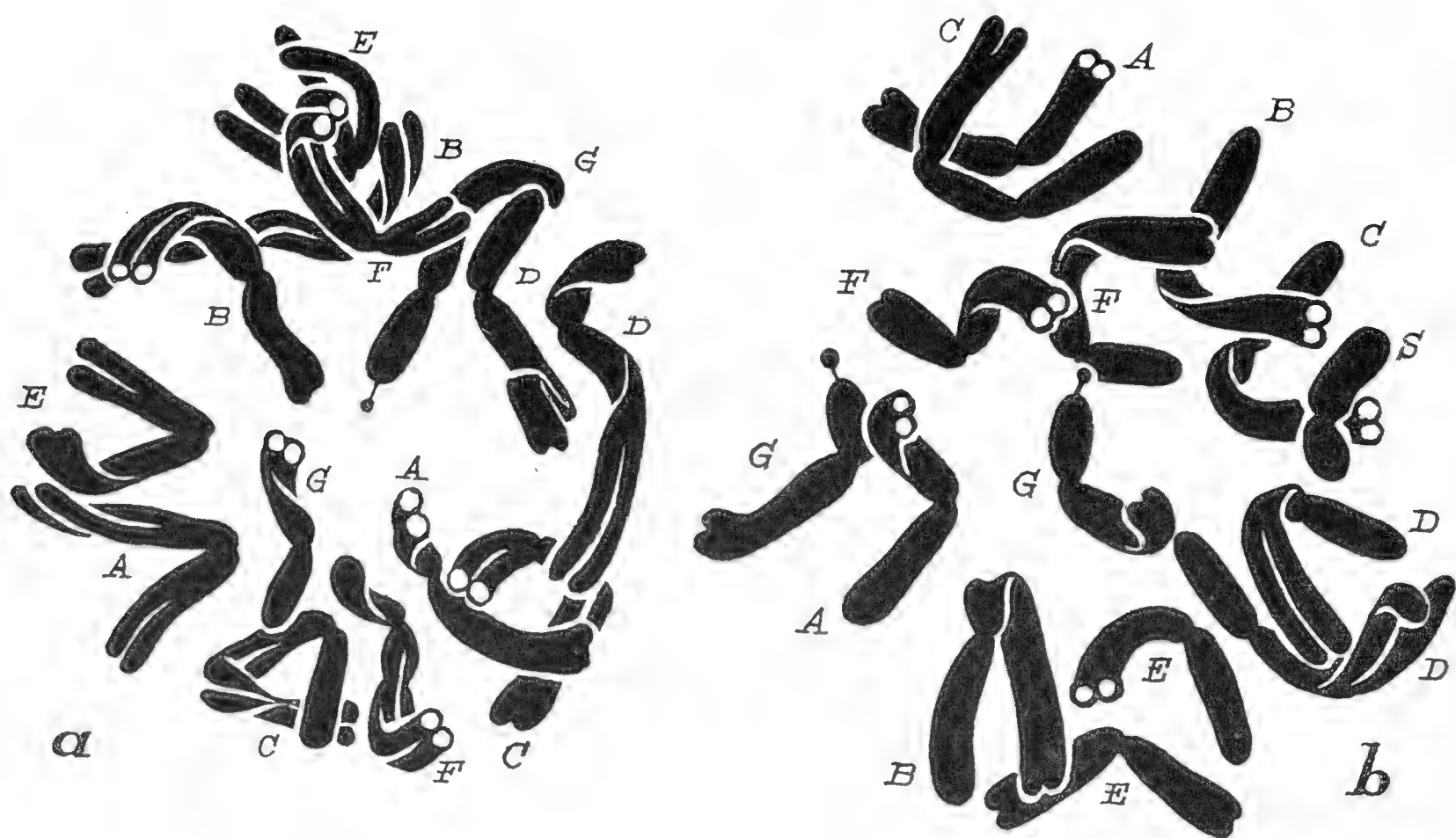


Fig. 159. *N. asturiensis* (Jord.) Pugsley. *a*, Equatorial plate with 14 chromosomes. *b*, Plate provided with a heterochromatic, supernumerary chromosome (S). X 3250.

In *N. asturiensis* we find some plants with 14 chromosomes (fig. 159a) and others with 15 (fig. 159b). The idiogram of the plants with 14 chromosomes is entirely similar to the previously mentioned forms. The plants with 15, present, aside from the normal complement, a

heterobrachial chromosome, simulating a Pp chromosome with shortened arms. The interphase nucleus shows a small chromocenter, disclosing that it is a question of a supernumerary, heterochromatic chromosome of the type of those that Fernandes (1939, 1943) described in *N. juncifolius* Lag. and *N. bulbocodium* L. Collins (1933) reports the existence

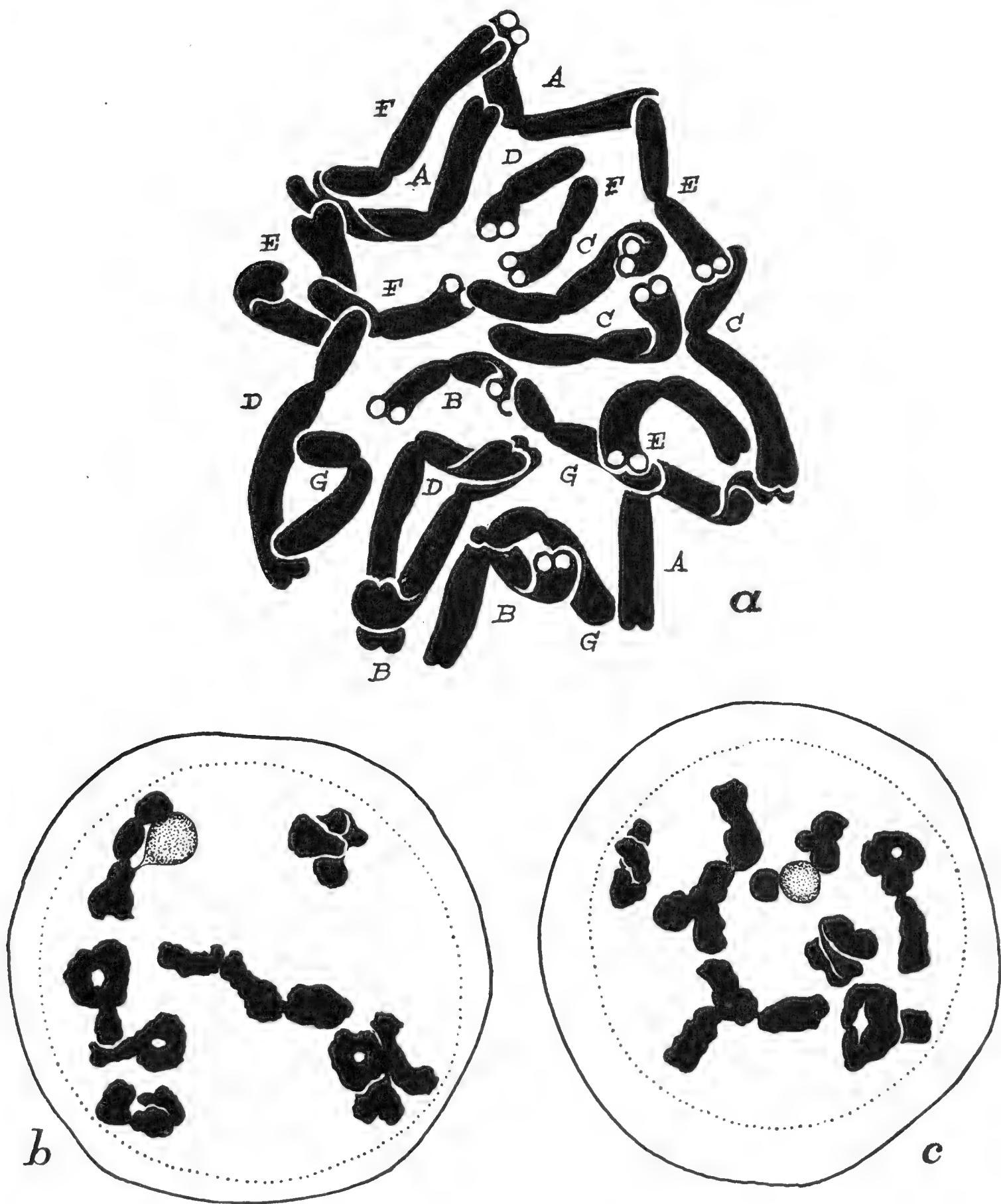


Fig. 160. *N. hispanicus* Gouan. *a*, Equatorial plate with 21 chromosomes in the root meristem cells. X 3250. *b*, Diakinesis showing 7 trivalents. *c*, The same showing 6 trivalents, a nucleolar bivalent and a univalent, also nucleolar. X 1050.

of 15 chromosomes in *N. minor* L. and *N. pumilus* Salisb., and Philp (1933, 1934) mentions the same number in *N. pallidiflorus* Pugsley. Our observations indicate that the normal chromosome complement of *N. minor* and *N. pumilus* is composed of 14 chromosomes. Accordingly, it is almost certain that *N. pallidiflorus* also has 14 chromosomes and that

the supernumerary elements found by Collins and Philp, are of the same nature as those we have found in *N. asturiensis*.

In *N. hispanicus*, we have found 21 somatic chromosomes, and the analysis of the plate reveals the existence of three chromosomes each, of the type distinguished in the haploid complement (fig. 160a). The chromosome complement is therefore expressed by the formula:

$$2n = 21 = 6 : Lm + 6 : Lp + 6 : li + 3 : Pp'$$

Diakinesis and metaphase of the heterotypic division almost always show 7 trivalents. The almost constant formation of this association (fig. 160b) indicates that the form studied is autotriploid.

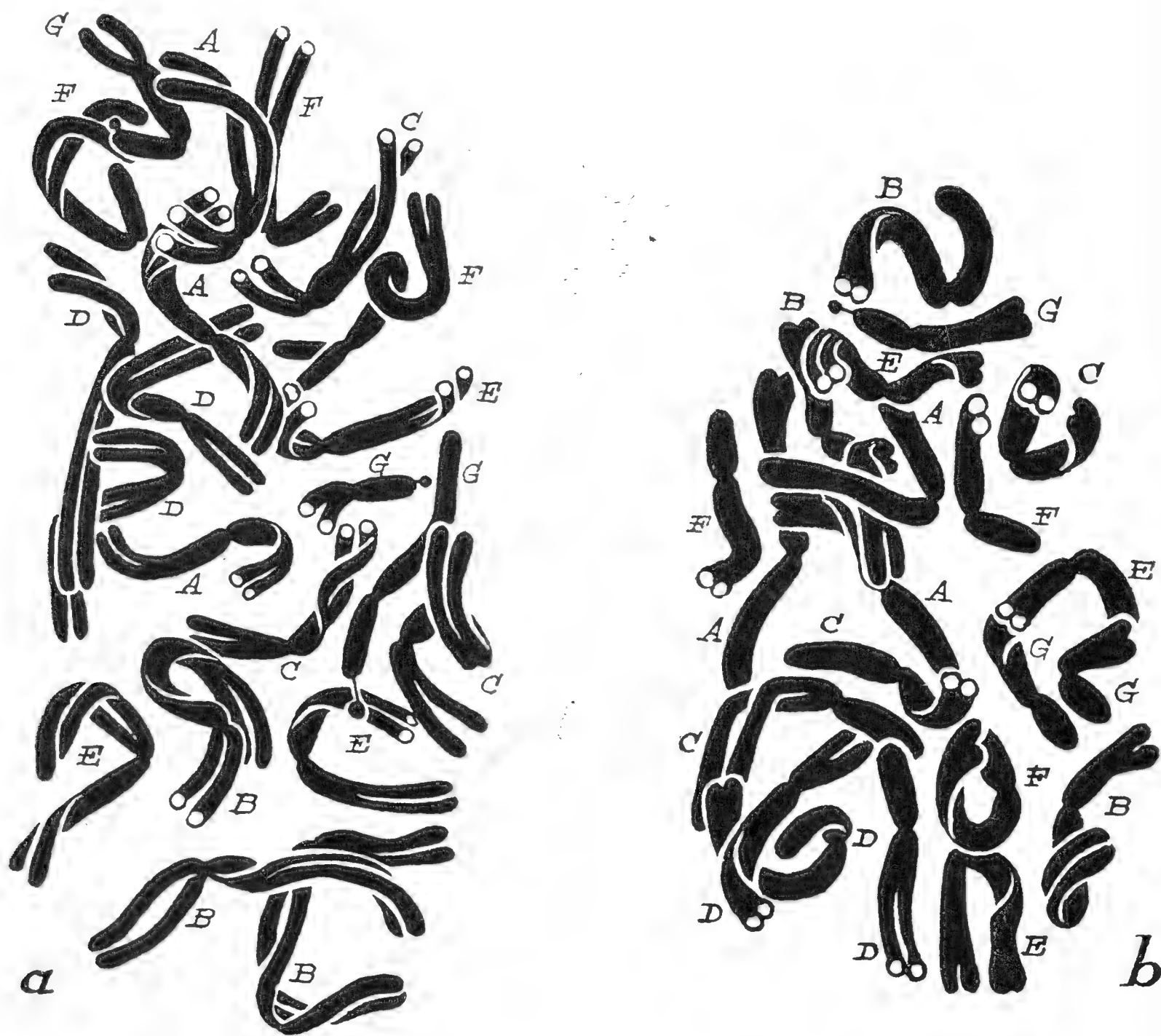


Fig. 161. Equatorial plate from the root meristem cells. *a*, *N. tortuosus* Haw. *b*, *N. trumpet* Emperor. Note the presence of three chromosomes each of the type A - G. X 3250.

Plate 295. (See opposite page for plate.) *N. hispanicus* Gouan. *a*, *b*, *c*, Anaphases of the heterotypic division showing some lagging. *d*, Telophase I showing laggards thrown out into the cytoplasm where they become micronuclei. *e*, Metaphase of the homotypic division showing 21 chromosomes; this cell produced 2 pollen grains with 21 chromosomes each. *f*, Telophase I, where such irregularity is not visible. X approx. 1400.

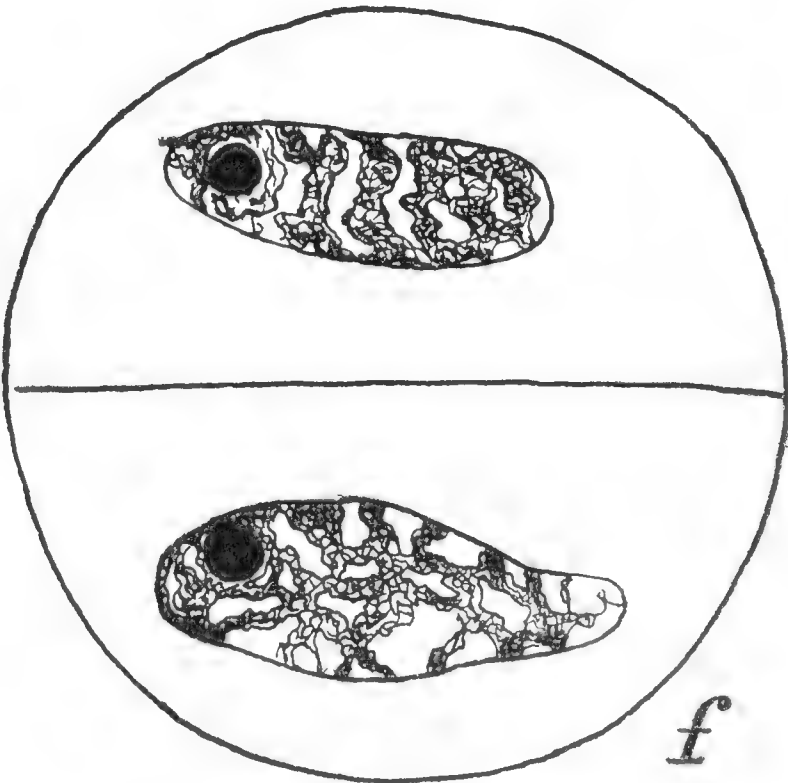
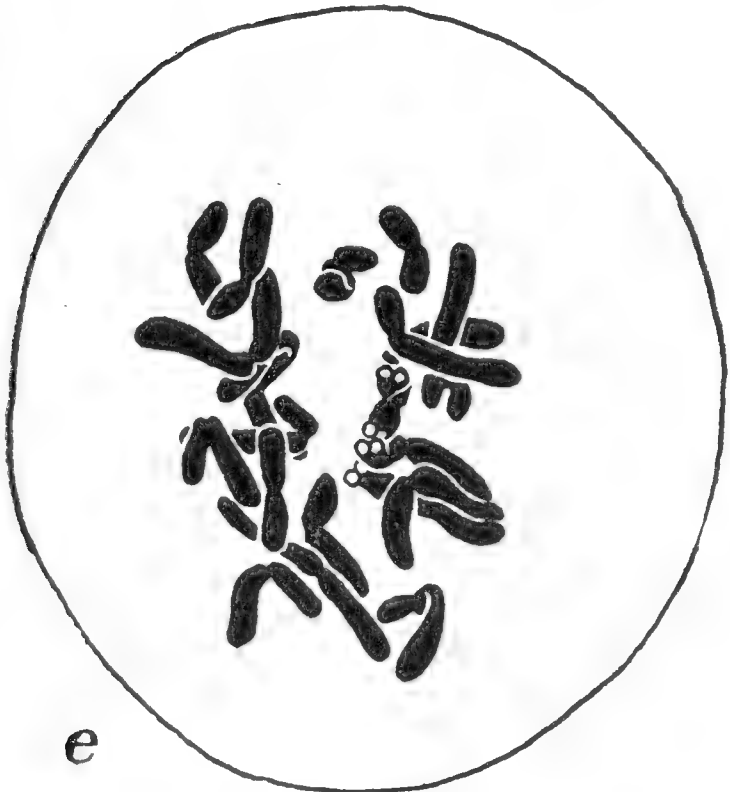
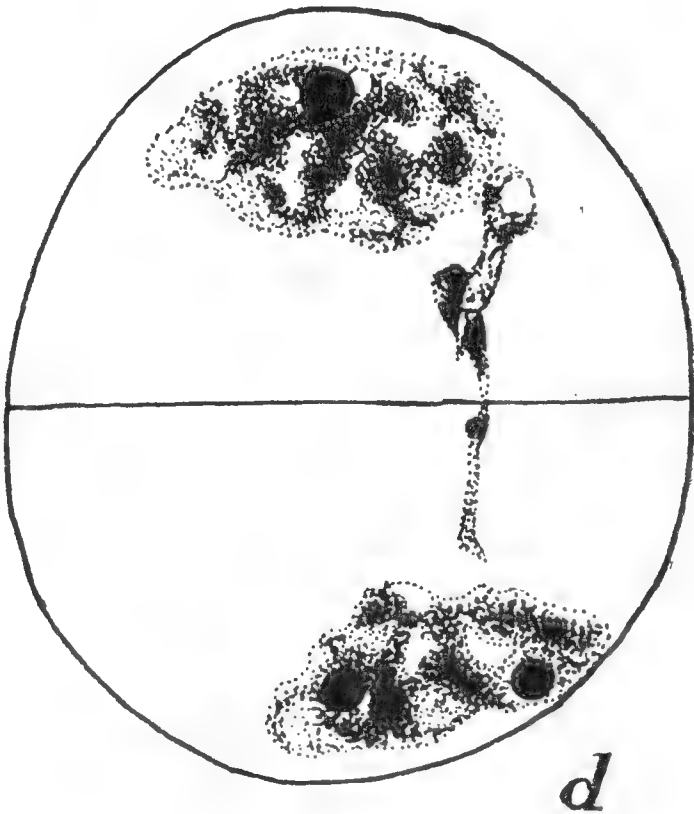
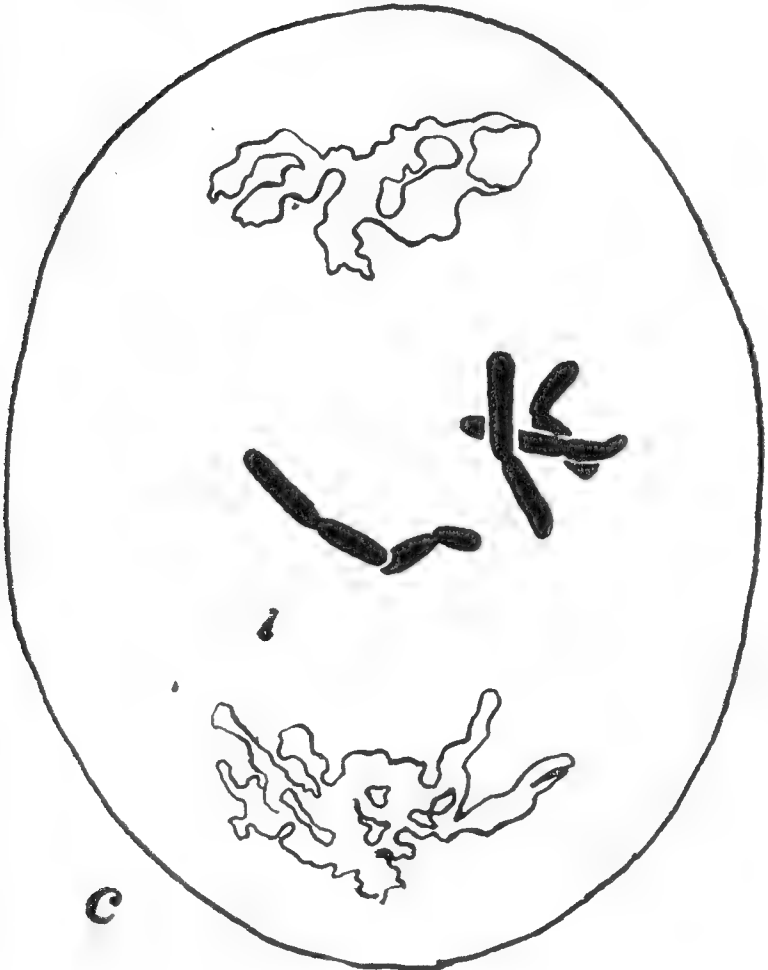
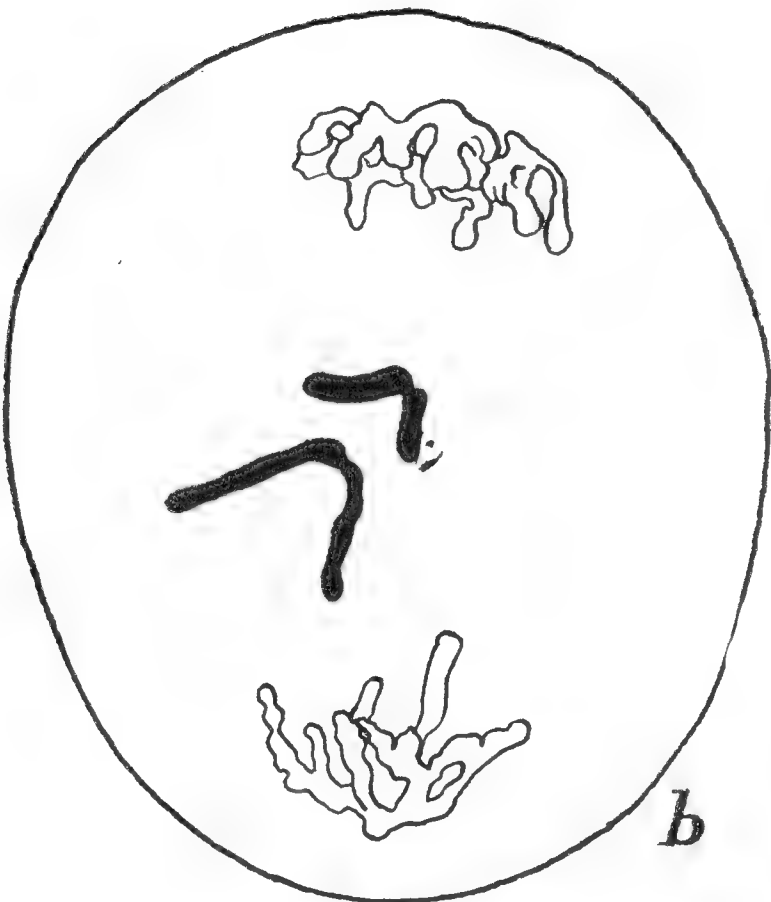
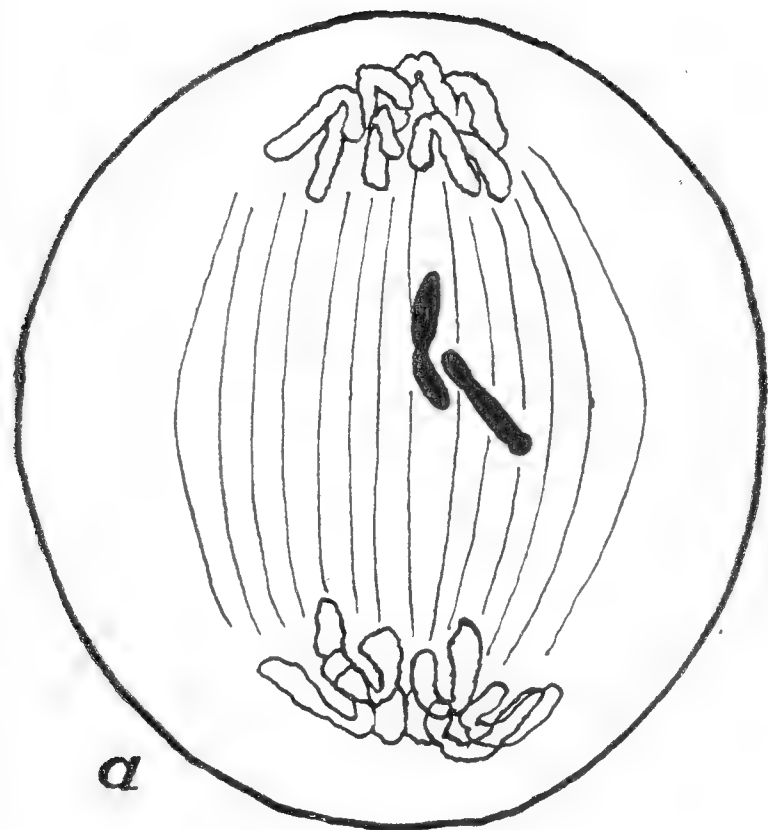


Plate 295 (see opposite page for details.)

Anaphase I (Plate 295a, b, c), telophase I (Plate 295d) and the second division indicate that the irregularities described are characteristic of autotriploid plants.

Philp (1933, 1934) also finds 21 chromosomes in the type species. However, in studying the variety *propinquus* (Herb.) Pugsley, he states

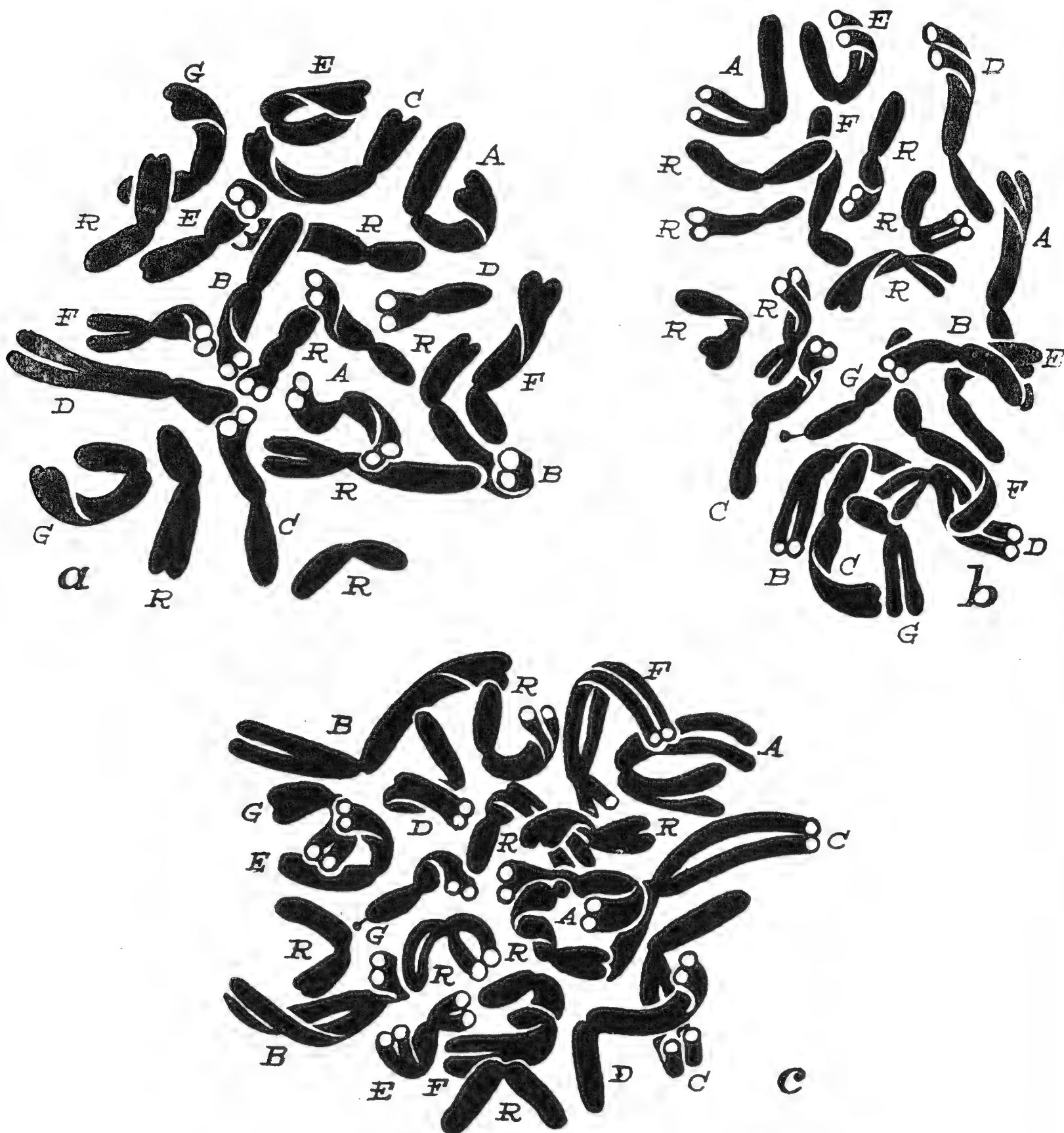


Fig. 162. *N. Johnstonii* Pugsley. *a*, *b*, Equatorial plate from the cells of a root meristem of a plant furnished by Fernandes Coimbra. *c*, The same, in another plant furnished by Maison Barr & Sons. In these figures the letters A - G indicate the chromosomes of a diploid complement of an *Ajax* and R the haploid complement of *N. reflexus* Brot. X 3250.

Plate 296. (See opposite page for plate.) *N. Johnstonii* Pugsley. *a*, Diakinesis showing 7 bivalents and 7 univalents. *b*, Metaphase I also showing 7 bivalents and 7 univalents. *c* and *d*, Metaphase I showing a trivalent in each cell. *e*, End of anaphase, showing two micronuclei and a bridge, accompanied by a small spherical fragment. *f*, Telophase I showing the same irregularities. X approx. 1400.

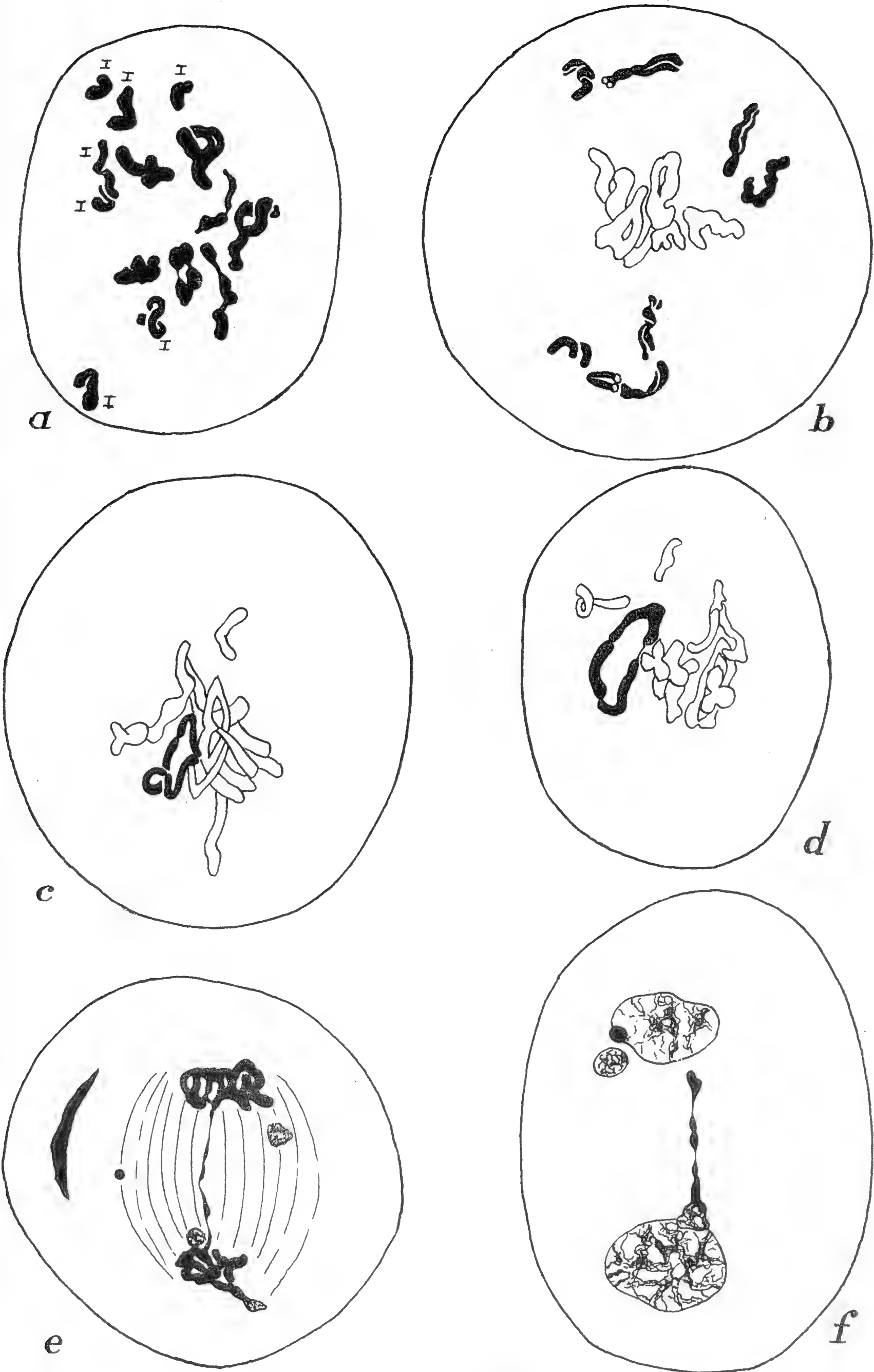


Plate 296 (see opposite page for details.)

that it is a diploid. There is thus in *N. hispanicus* intraspecific polyploidy, the variety being diploid and the type triploid.

Narcissus tortuosus and *N. trumpet* Emperor have also proven to be triploid. Figures 161a and 161b show that in this form the haploid complement is found repeated three times.

In *N. Johnstonii*, we find 21 chromosomes, either in the material furnished by Fernandes Coimbra (figs. 162a, 162b), or in that which was sent by Maison Barr & Sons (fig. 162c). Our observations confirm those of Philp (1933, 1934), concerning chromosome number.

From the fact that spiralization is greatly extended, the chromosomes at metaphase become so long, that to study their morphology is difficult. However, we have succeeded in obtaining some plates where the chromosomes are much shortened, which permitted us to establish the following chromosome formula:

$$2n = 21 = 4 : Lm + 7 : Lp + 4 : li + 1 : lm + 2 : PP + 3 : Pp$$

An analysis of this formula leads us to the conclusion that *N. Johnstonii* is not an autotriploid, since in its idiogram, we do not find the haploid complement represented three times. The presence of 4 chromosomes of the type *Lm* and 4 of the type *li* shows at once that this species possess the haploid complement of *Ajax* repeated two times. In making this withdrawal in the formula below, of the diploid complement, there remains a complement of 7 chromosomes expressed by the formula:

$$n = 3 : Lp + 1 : lm + 2 : PP + 1 : Pp$$

which corresponds exactly to that found in *N. reflexus* Brot., *N. triandrus* L. and *N. bulbocodium* L. The conclusion is reached therefore, that *N. Johnstonii* is a hybrid of a tetraploid form of *Ajax* and a diploid form, of either a *Ganymedes*, or a *Corbularia*.

A study of meiosis in the pollen mother cells confirms this point of view. Indeed, diakinesis (Plate 296a) show 7 bivalents, corresponding to the 14 elements of the *Ajax* complement, and 7 univalents, corresponding to the haploid complement of the other species. The same conformation has been observed in metaphase I, when the bivalents are disposed on an equatorial plane, while the univalents are found, most frequently, in an irregular fashion, on one part or the other of the equatorial plane (Plate 296b). Trivalents have been observed several times (Plate 296c, d).

Plate 297. (See opposite page for plate.) Equatorial plate in the cells of the root meristem. *a*, *N. trumpet* Impératrice ($2n = 22$); note the presence of four B chromosomes. *b*, *N. pseudo-narcissus* L. var. *bicolor* (L) ($2n = 28$). *c*, *N. King Alfred* ($2n = 28$). X 3250.

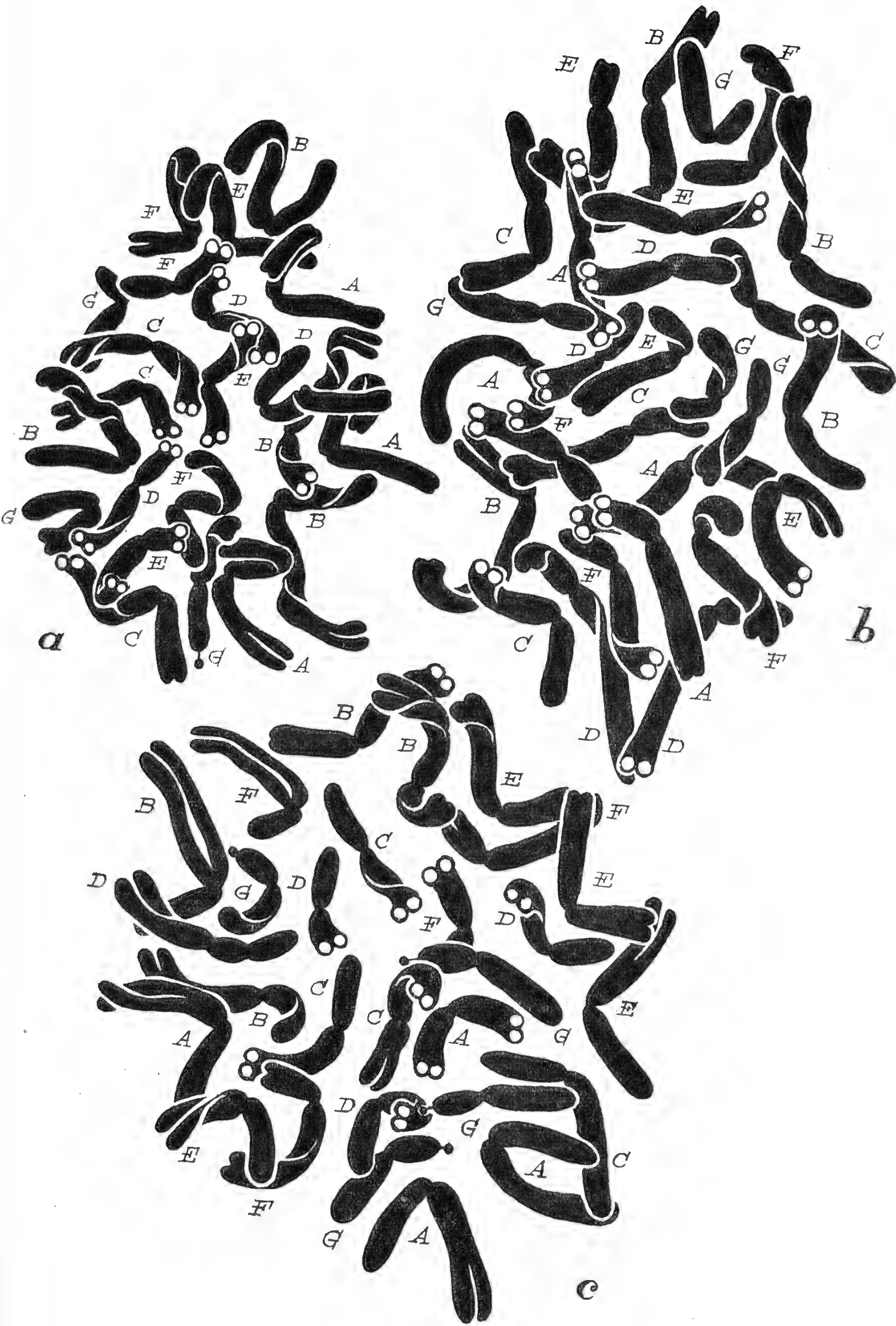


Plate 297 (see opposite page for details.)

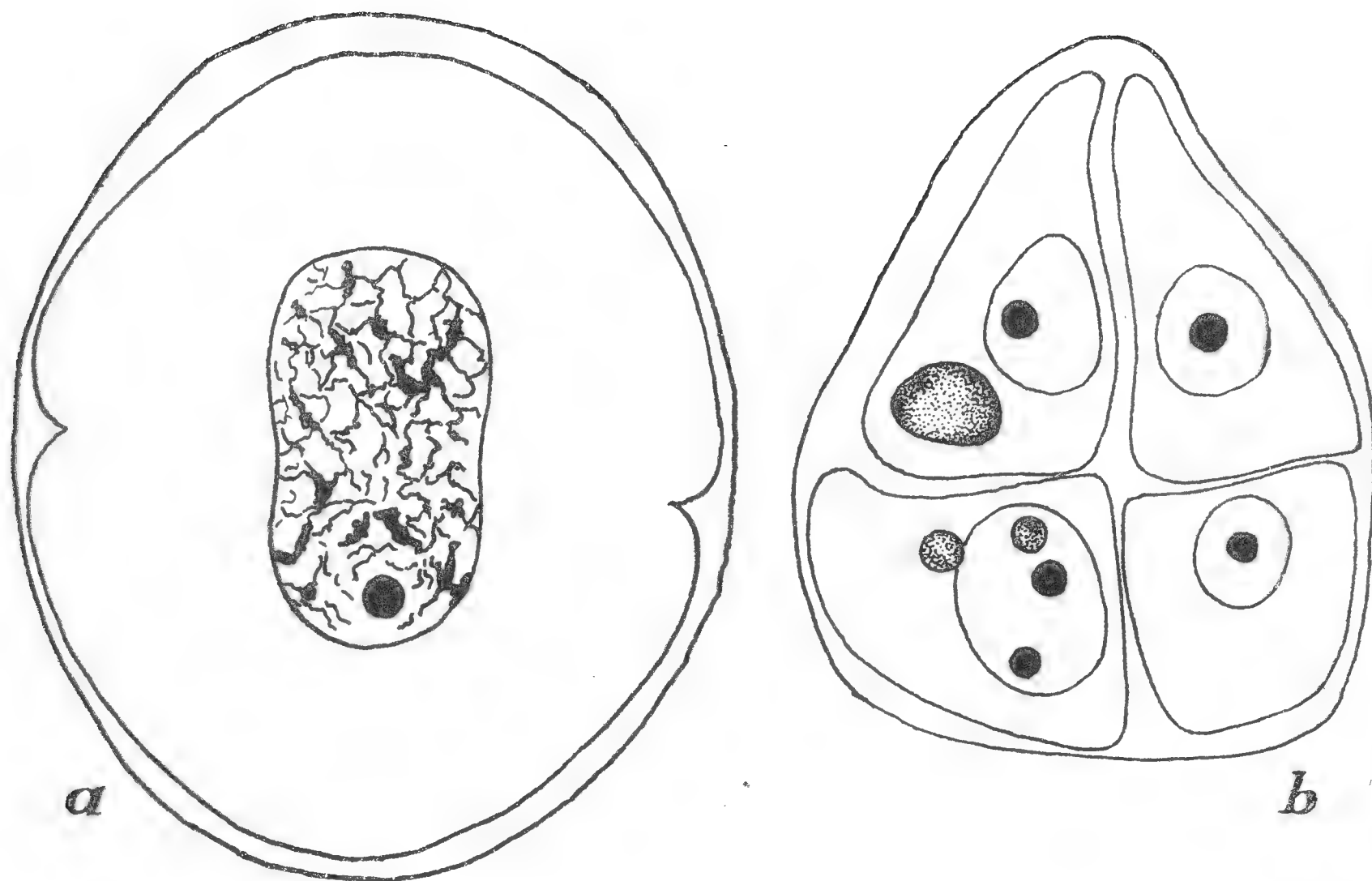


Fig. 163. *N. Johnstonii* Pugsley. *a*, Restitution nucleus formed at telophase I. *b*, Tetrad showing micronuclei in two of the 4 microspores. X approx. 1450.

As is to be expected meiosis is irregular (Plate 296e, f) and it takes place in a fashion entirely comparable with that which the authors have described for *N. jonquilloides* Willk., a species which is also a hybrid of a tetraploid form of *N. jonquilla* L. and a diploid form of *N. gaditanus* Boiss. and Reut.

Restitution nuclei sometimes have been observed (fig. 163a). These nuclei produce dyads of 21 chromosomes, and the resulting gametes are able, by fusion to give origin to hexaploids, which are probably stable and fertile.

In *N. trumpet* Impératrice, we have found 22 chromosomes (Plate 297a) whose morphology is expressed by the formula:

$$2n=22=7:Lm+6:Lp+6:li+3:Pp$$

Accordingly, this horticultural form is shown to be hypertriploid on account of having a chromosome of the type Lm. A more intensive analysis indicates that the supernumerary chromosome belongs to type B (see Plate 297a). This form has originated by means of hybridization of a diploid gamete, produced by a tetraploid form, with another gamete of 8 chromosomes ($3:Lm+2:Lp+2:li+1:Pp$), formed by the non-disjunction of the bivalent Lm in a diploid form.

Other horticultural forms with 22 chromosomes are already known: Bicolor Victoria (de Mol, 1922; Philp, 1934), Buttonhole (de Mol, 1922), Empress (Nagao, 1929, 1933; Philp, 1934), Grandee (Nagao, 1929, 1933), Bicolor Horsfieldii (Philp, 1934) and Victoria (Sikka, 1940).

Meiosis has been studied by Nagao (1933) in Grandee and Empress and the results indicate that these forms are hypertriploids, like *N. trumpet Impératrice*.

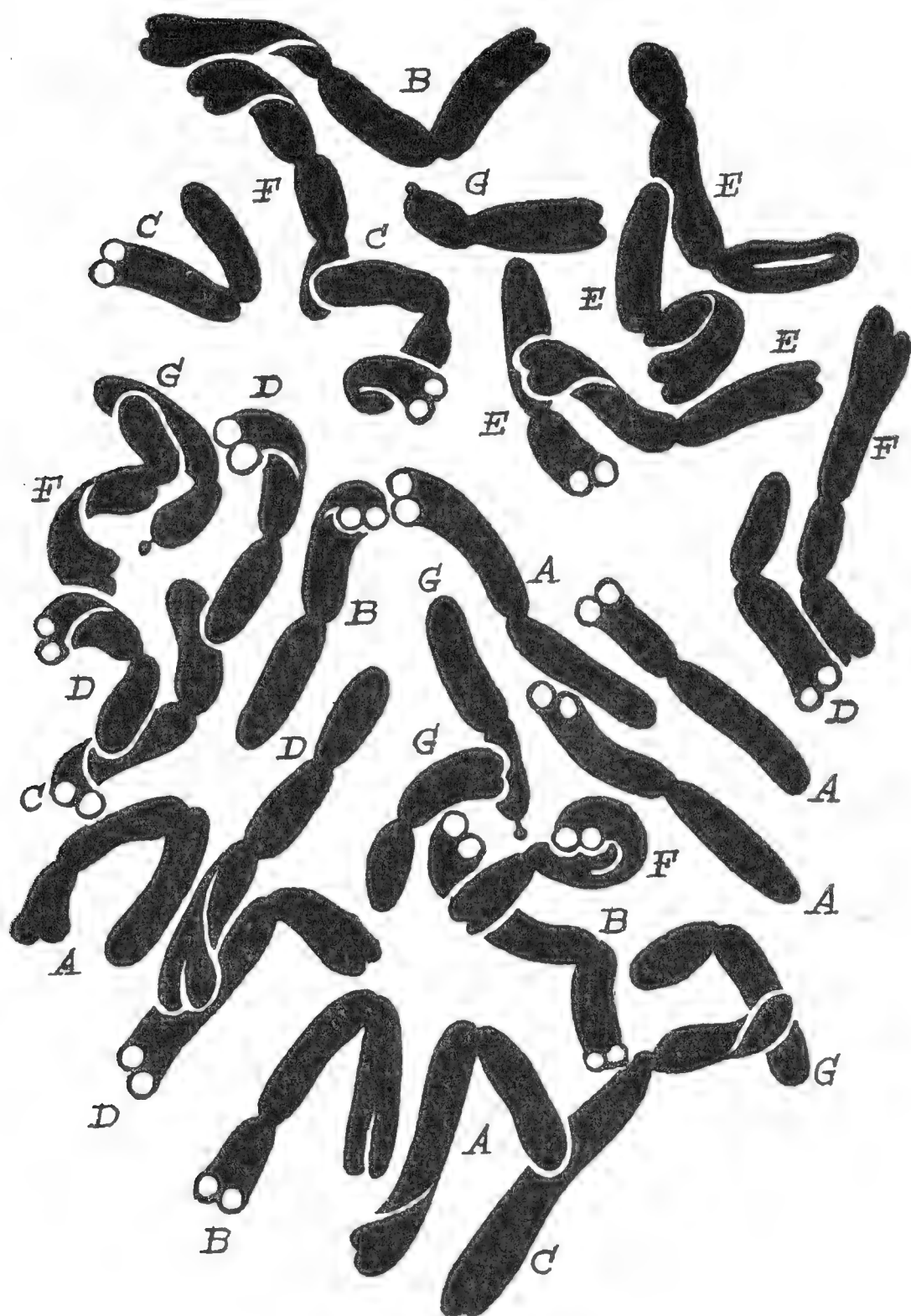


Fig. 164. *N. trumpet* M.me de Graff. Equatorial plate in the cells of the root meristems showing 31 chromosomes. X 3250.

Narcissus pseudo-narcissus L. var *bicolor* (L.) and the horticultural form, "King Alfred" show 28 chromosomes in the cells of the root meristem. The idiogram is represented by the formula:

$$2n = 28 = 8 : Lm + 8 : Lp + 8 : li + 4 : Pp'$$

These two forms present therefore chromosomes of the haploid complement A—G repeated 4 times. Consequently, it is a question of autotetraploidy.

Narcissus trumpet M.me de Graff shows 31 chromosomes in the cells

of the root meristems (fig. 164). The formula indicating the morphology of its chromosomes is the following:

$$2n = 8:Lm + 9:Lp + 9:li + 5:Pp$$

M.me de Graff is therefore a hypertetraploid, in the complement of which, one finds repeated five times, a chromosome of type Lp (D), another li (A) and another Pp (G). This horticultural form, from this fact, was produced by hybridization of a tetraploid gamete of the form (4:Lm + 4:Lp + 4:li + 2:Pp', that is to say, 2A + 2B + 2C + 2D + 2E + 2F + 2G) with a gamete of 17 chromosomes (4:Lm + 5:Lp + 5:li + 3:Pp') that is to say, 3A + 2B + 2C + 3D + 2E + 2F + 3G), produced by a pentaploid form. However, pentaploid forms have not been found up to the present in *Ajax*.

DISCUSSION

In the list given below, where the species are found arranged according to the classification of Pugsley (1933), we have assembled the number of chromosome counts which have been made up to the present in each of these species.

Section I

- | | |
|---------------------------------|--|
| 1. <i>N. cyclamineus</i> DC. | 14 de Mol (1922); Collins (1933);
Fernandes (1933); Fernandes
& Fernandes (<i>hic</i>).* |
| 2. <i>N. Johnstonii</i> Pugsley | 21 Philp (1933, 1934); Fernandes
& Fernandes (<i>hic</i>). |

Section II

Series I Minores

- | | |
|--|--|
| 3. <i>N. asturiensis</i> (Jord.) Pugsley | 14 Fernandes (1931); Collins
(1933); Fernandes & Fernan-
des (<i>hic</i>).
15 Fernandes & Fernandes (<i>hic</i>). |
| 4. <i>N. Lagoi</i> Merino | |
| 5. <i>N. minor</i> L. | 14 de Mol (1922); Fernandes &
Fernandes (<i>hic</i>).
15 Collins (1933). |
| 6. <i>N. pumilus</i> Salisb. | 14 Fernandes & Fernandes (<i>hic</i>).
15 Collins (1933). |
| 7. <i>N. nanus</i> Spach | 14 de Mol (1922); Philp (1933,
1934); Fernandes & Fernandes
(<i>hic</i>). |
| 8. <i>N. parviflorus</i> (Jord) Pugsley | |

* [Translator's note: "**hic**" is the Latin equivalent of "this." Thus reference is made to the work reported in the present paper.]

Series II Lutei

- | | |
|---|---|
| 9. <i>N. hispanicus</i> Gouan | 21 de Mol (1922); Philp (1933, 1934); Fernandes & Fernandes (<i>hic</i>). |
| var. <i>propinquus</i> (Herb.)
Pugsley | 14 Philp (1933). |
| 10. <i>N. longispathus</i> Pugsley | |
| 11. <i>N. obvallaris</i> Salisb. | 14 Philp (1933, 1934); Fernandes & Fernandes (<i>hic</i>). |
| 12. <i>N. pisanus</i> Pugsley | |
| 13. <i>N. confusus</i> Pugsley | |
| 14. <i>N. portensis</i> Pugsley? (<i>N. Pseudo-Narcissus</i> L. var. <i>concolor</i> in Coutinho, Flora of Portugal. | 14 Fernandes & Fernandes (<i>hic</i>). |
| 15. <i>N. nevadensis</i> Pugsley | |

Series III Vulgares

- | | |
|---|--|
| 16. <i>N. pseudo-narcissus</i> L. | 14 Philp (1933, 1934); Fernandes & Fernandes (<i>hic</i>). |
| 17. <i>N. pallidiflorus</i> Pugsley | 15 Philp (1933, 1934). |
| 18. <i>N. macrolobus</i> (Jord.)
Pugsley | |

Series IV Nobiles

- | | |
|------------------------------------|--|
| 19. <i>N. Gayi</i> (Hénon) Pugsley | 14 Philp (1933, 1934); Nagao (1929, 1933); Fernandes & Fernandes (<i>hic</i>). |
| 20. <i>N. nobilis</i> Schultes f. | |
| 21. <i>N. leonensis</i> Pugsley | |

Series V Albiflori

- | | |
|--|--|
| 22. <i>N. moschatus</i> L. | 14 Philp (1933, 1934); Fernandes & Fernandes (<i>hic</i>). |
| 23. <i>N. alpestris</i> Pugsley | 14 Collins (1933). |
| 24. <i>N. tortuosus</i> Haw. | 21 Fernandes & Fernandes (<i>hic</i>). |
| 25. <i>N. albescens</i> Pugsley | 14 Nagao (1929). |
| 26. <i>N. bicolor</i> L.? (<i>N. pseudo-narcissus</i> L. var. <i>bicolor</i> (L.) in Coutinho, Flora of Portugal. | 28 Fernandes (1933); Fernandes & Fernandes (<i>hic</i>). |
| 27. <i>N. absissus</i> Schultes f. | 14 de Mol (1922). |

An analysis of this list shows that we do not possess data on the karyology of 9 of these species. However, by the fact that all of the series established by Pugsley (1933), possess representatives which have been studied, we can state that probably all of the species, with the ex-

ception of *N. Johnstonii*, have the same fundamental chromosome complement, represented by the formula:

$$b=7=2:Lm+2:Lp+2:li+1:Pp'$$

Apart from *N. Johnstonii*, *N. hispanicus*, *N. tortuosus* and probably *N. bicolor*, all the other species are diploids with 14 chromosomes. From the fact that their idiograms are similar, their karyology does not contribute any data which would permit us to separate these species. In considering even the most distinct forms, *N. cyclamineus* and *N. asturiensis*, we can state that their separation is not possible.

With respect to *N. hispanicus*, we have established in this species diploid forms (the var. *propinquus*) and autotriploids (the type). Here we have intraspecific polyploidy and triploidy which does not permit the effective separation of these forms as distinct species.

With respect to *N. tortuosus* and *N. bicolor*, we have studied only a few examples. We can assume that diploids also exist in these species. Accordingly, we can for the moment consider that triploidy and tetraploidy permit us to separate them.

In summary, we can say that the sub-genus *Ajax*, appears to be a homogenous group, where the Jordonian species established by Pugsley (1933) belong to the same karyotype; there is some polyploidy; but we know that it is not sufficient to permit the separation of the species. The karyology is found to be in accord with the ideas of Baker (1888), who considered this group constituted a single, very polymorphic, Linnéan species.

With regard to *N. Johnstonii*, Henriques (1887) has been the first to suggest that this form could be a hybrid. Barr (1888) considered this plant originated by crossing of *N. pseudo-narcissus* and *N. triandrus albus* (*N. reflexus* Brot.). Peter R. Barr (1929) showed that in harmony with the opinion of his father, the plants concerned either were found by someone in Spain, or were those received by A. W. Tait from Portugal (in the vicinity of Pôrto). In his catalogue of 1937, Barr also considered *N. Queen of Spain* as a hybrid of *N. pseudo-narcissus* and *N. triandrus albus*. Jacob and Calvert (1929) also considered *N. Johnstonii* as a hybrid of *Ajax* and a *triandrus*. Bowles (1934) is of the same opinion, and has substantiated it with the statement that "similar forms have been raised frequently in gardens by crossing *N. triandrus* with a yellow *Ajax*."

Baker (1888) did not attribute its origin to hybridization and considered it as a variety of *N. pseudo-narcissus*. Pugsley (1933) did not believe either in the hybridity of *N. Johnstonii*. In fact, he said, "If *N. Johnstonii* is a *triandrus* hybrid, it is remarkable that it uniformly possesses the equal stamens with linear, sub-basifixed anthers of an *Ajax*; and if a *bulbocodium* cross some curvature of the stamens and style would be expected. The lack of these peculiarities tends to show that no *triandrus* or *bulbocodium* element is present, as does also the relatively broad and flat foliage; and these features seem to outweigh the somewhat *triandrus*-like corona, and the narrow perianth-tube and

segments recalling *bulbocodium*. Moreover, at least in French gardens, the plant produces fully developed capsules and might perfect seeds under favorable conditions. Another fact that tells against hybridity is the plant's abundance. For nearly forty years it must have been collected annually for export in considerable quantity, for wild bulbs have been almost continuously on sale since the early nineties, in some years being offered by the thousand. It is difficult to believe that a *Narcissus* of hybrid could have multiplied to such an extent and remained so uniform. The "Queen of Spain" is therefore treated as an *Ajax*, and, in view of its very distinct features, has been raised to specific rank." (Pugsley, 1933, pg. 38-39).

As we have noted, the karyological data, suggested from all evidence, that *N. Johnstonii* is a hybrid of a tetraploid form of an *Ajax* and a diploid form of a *Ganymedes* or a *Bulbocodium* (these two groups possess similar complements, as Fernandes, 1935, 1936b, has shown). The data of external morphology—flowers more or less inclined, segments of the perianth reflexed, form of the corona, tube of the perianth "more narrowly funnel-shaped than in the other species of *Ajax*," (Pugsley, 1933), color of the flower, the exceptional existence of two flowers, etc.—show, at once, that the diploid parent is *N. reflexus* Brot. We are therefore in accord with the point of view of Henriques, Barr, P. R. Barr, Jacob, Calvert and Bowles.

However, the arguments of Pugsley, which speak against the idea of considering *N. Johnstonii* as a hybrid, are quite justified. How can we explain the facts mentioned by this author? In our opinion, the explanation is to be found in the fact that *N. Johnstonii* is not a hybrid of two diploid forms, but a hybrid of a tetraploid form of *Ajax* and a diploid one of *N. reflexus* Brot. Given this constitution, a greater predominance of the *Ajax* parent is to be expected. Thus it is explained how the leaves can be relatively large and flat, that the stamens are equal, with linear, sub-basifixed anthers.

The fact that *N. Johnstonii* can, especially in French gardens, produce capsules with fertile seed, is explained thus:—the diploid complement of the *Ajax* parent forms 7 bivalents, which disjoin regularly. The univalents of the *N. reflexus* are frequently eliminated in the cytoplasm and gametes with the *Ajax* complement can be formed. Fertilization of these gametes produces fertile seed. This seed evidently produces some *Ajax* and it should be interesting to study plants obtained by germination of this seed.

The extraordinary abundance of plants can be explained by assuming that *N. Johnstonii* possesses a great capacity to multiply vegetatively. The case of *N. jonquilloides*, which as we have shown, possess a constitution comparable to that of *N. Johnstonii*, is entirely worthy of being connected with this fact. *Narcissus jonquilloides* Willk. never develops, at least in our cultures, fertile seed. In spite of this, it multiplies vegetatively in a truly extraordinary fashion, since some pots which have been planted with bulbs were found completely filled in several years.

Among the plants collected by Johnston and A. W. Tait in the

vicinity of Pôrto, Henriques (1887) found one to which he gave the name *N. Taiti* and which he considered, in harmony with its external morphological characters, to be a hybrid of *N. pseudo-narcissus* and *N. reflexus* Brot. (*N. calathinus* L.). In mentioning this plant, Pugsley (1933) says that the exceptional solitary flower figured by Henriques resembles *N. Johnstonii*. However, he noted that the segments of the perianth are not reflexed and that the stamens are unequal. It would have been interesting to study this plant. Is it a question of a true *N. Johnstonii* or a hybrid between the diploid forms of *N. pseudo-narcissus* and *N. reflexus*? According to the characters of external morphology, which shows a greater predominance of the characters of *N. reflexus* than those of *N. Johnstonii*, the second hypothesis seems very probable. Unfortunately, in spite of our efforts we have not succeeded in procuring this plant.

According to the data of Tait (1886), *N. pseudo-narcissus* is present in the same locality in the vicinity of Pôrto, in two forms, one of which is more robust than the other. It is probable that the large, high form is tetraploid and the other diploid. Given these facts, that *N. reflexus* Brot. growing with these forms of *N. pseudo-narcissus* and that the two species are able to flower simultaneously, it seems probable that the two hybrids, *N. Taiti* and *N. Johnstonii*, have originated in the neighborhood of Pôrto, by crossing, respectively, the diploid and tetraploid forms of *N. pseudo-narcissus* with diploid forms of *N. reflexus*.

From the fact that a great majority of these species possess similar idiograms, constituted of 14 chromosomes, we can say that the evolution of *Ajax* in the wild state has taken place particularly by single gene mutations, or accompanied by structural alterations which do not effect the morphology of the chromosomes in such a fashion that they are evident by comparison of somatic plates. Polyploidy has also played its role, but its importance, from the point of view of the formation of new species, cannot yet be estimated. Tetraploidy and hybridization have been responsible for the differentiation of *N. Johnstonii*.

Very numerous forms of *Ajax* are obtained in culture. However, we only know the karyology of the forms mentioned in the following list:

<i>N.</i> yellow double Van Sion (<i>Telamonius plenus</i>).	14	de Mol (1922, 1928); Fernandes & Fernandes (<i>hic</i>).
<i>N.</i> trumpet major	14	Philip (1934); Fernandes & Fernandes (<i>hic</i>).
<i>N.</i> trumpet King of the Yellows	14	Fernandes & Fernandes (<i>hic</i>).
<i>N.</i> Henry Irving	14	Philp (1934).
Victoria	14	Nagao (1929).
Victoria	22	Sikka (1940).
Golden Spur	21	de Mol (1922).
Golden Spur	30	Nagao (1929).
<i>N.</i> trumpet Emperor	21	Nagao (1933); Fernandes & Fernandes (<i>hic</i>).

Bicolor Victoria	22	de Mol (1922); Philp (1934).
Buttonhole	22	de Mol (1922).
Empress	22	Nagao (1929, 1933); Philp (1934).
Grandee	22	Nagao (1929, 1930, 1933).
<i>N. bicolor</i> Horsfieldii	22	Philp (1934).
<i>N. trumpet</i> Impératrice	22	Fernandes & Fernandes (<i>hic</i>).
King Alfred	28	de Mol (1922); Nagao (1929, 1933); Sikka (1940); Fernandes & Fernandes (<i>hic</i>).
Van Waveren's Giant	28	de Mol (1922).
Olympia	28	Nagao (1929, 1933).
<i>N. trumpet</i> M.me de Graff	31	Fernandes & Fernandes (<i>hic</i>).

An analysis of this list shows that 5 forms are diploids, 2 triploids, 7 hypertriploids with $2n=22$, 3 tetraploids and 2 hypertetraploids. This data reveals therefore that polyploidy alone, and polyploidy associated with polysomy have played an important role in the differentiation of horticultural forms.

Bowles (1934) states that the form Emperor has been produced by means of hybridization of *N. bicolor* and *N. pseudo-narcissus*. Assuming that the first species is a tetraploid and second a diploid, the chromosome number, $2n=21$, is in accord with this supposition.

From the fact that he did not succeed in identifying the existence of 4 similar haploid chromosome complements in the idiogram of King Arthur and also based on the morphology of the satellited chromosome Sikka, (1940) was led to the conclusion that his form is an allotetraploid. Our observations, on the contrary, show that the complement of King Alfred possesses exactly 4 chromosomes each of the 7 types A—G identified in the haploid complement, even as far as concerns the satellited chromosomes. King Alfred should therefore be considered as an autotetraploid, this is in accord with the observations of Nagao (1933), who showed a very frequent formation of tetravalents during the reduction divisions. The figures observed by Sikka (1940), have been produced by interesting translocations in the nucleogenio regions and, from this fact, they cannot be used to show the existence of diploid complements of two different species reunited in the idiogram of King Alfred.

Sikka (1940) expresses the supposition that King Alfred must have originated by fertilization of a non-reduced female gamete of the form Emperor with a haploid gamete of *N. hispanicus* var. *maximus* (*N. major*). This hypothesis is not in harmony with the facts, since *N. hispanicus* (*N. major*) is a triploid like Emperor. It is therefore, most probable that King Alfred has originated by fertilization of two non-reduced gametes produced by a diploid form of *N. hispanicus*, such as the variety *propinquus*.

SUMMARY AND CONCLUSIONS

1. With the exception of *N. Johnstonii*, all the species established by Pugsley (1933) in the sub-genus *Ajax* present the same fundamental chromosome complement, expressed by the formula $n=7=2:Lm+2:Lp+2:li+1:Pp'$. Of 18 of these species, 14 are shown to be diploids, and one, *N. hispanicus*, is shown to be constituted of diploid and triploid forms. *N. tortuosus* is shown to be a triploid, and *N. bicolor* tetraploid. However, we have not established that these last two species do not have diploid forms.
2. The appearance in *N. asturiensis*, *N. minor*, *N. pumilus* and *N. pallidiflorus* of plants with 15 somatic chromosomes should be attributed in these species, to supernumerary, heterochromatic chromosomes of the type of those which have been found in *N. juncifolius* Lag. and *N. bulbocodium* L.
3. *Narcissus Johnstonii* possesses an idiogram represented by the formula:

$$2n=21=4:Lm+7:Lp+4:li+1:lm+2:PP+3:Pp$$

This formula corresponds exactly to the addition of a diploid complement of *Ajax* with a haploid complement of *N. reflexus* Brot.

<i>Ajax</i>	$2n=4:Lm+4:Lp+4:li+$	$2:Pp$
<i>N. reflexus</i>	$n=3:Lp+$	$1:lm+2:PP+1:Pp$
	$3n=4:Lm+7:Lp+4:li+1:lm+2:PP+3:Pp$	

4. By the fact that *N. Taiti* Henriq. presents some characters of *N. reflexus* in a more manifest degree than *N. Johnstonii*, we have suggested that this hybrid originated by means of crossing two diploid forms of *N. Pseudo-Narcissus* L. and *N. reflexus* Brot.
5. The karyological data, except perhaps for *N. tortuosus* and *N. bicolor*, does not furnish any elements which would permit us to separate the Jordonian species established by Pugsley (1933). The fact that all the species possess the same karyotype is in harmony with the ideas of Baker (1888), who considered the group to be a single, very polymorphic, linnean species. The most distinct species, *N. cyclamineus* and *N. asturiensis* cannot be distinguished from the others, from a karyological point of view.
6. The principal role in the evolution of the group in the wild state has been played by gene mutation, alone or accompanied by structural alterations not modifying in a visible fashion the chromosome complement. Polyploidy has also played a role, however its importance cannot yet be estimated, because of the fact that we have not been able to effectuate an intensive study of *N. tortuosus* and *N. bicolor*, and some species (9) yet remain to be investigated.
7. A list of the chromosome numbers of horticultural forms studied up to the present is given. This list indicates that the origin of some

forms can be attributed to gene mutation, but the principal role has been played by polyploidy alone, or polyploidy associated with polysomy.

8. The karyological data is found to be in accord with the question of considering the form Emperor ($2n=21$) as having originated by fertilization of *N. bicolor* ($2n=28$) with *N. pseudo-narcissus* ($2n=14$).
9. King Alfred should be considered an autotetraploid form and M.me de Graff could have been produced by fertilization of a tetraploid form with a pentaploid one.

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PARENTS OF HYBRID DAFFODILS

ARNO H. BOWERS, *Chairman*
Narcissus Committee

For the past five years I have been trying to obtain parental names of various daffodil hybrids, sometimes with success but often not. Generally I was referred to the excellent list of crosses compiled by A. F. Calvert, F. C. S., published in the Royal Horticultural Society Daffodil Yearbook, 1936. On most newer daffodils, however, this gave little help.

Like many others who accumulate this information on later hybrids, I have kept it on odd cards, loose scraps of paper and in marginal notes of catalogs or notebooks, intending as they no doubt have to sometime assemble it into one orderly list. Pressure and a competent secretary finally accomplished this.

The following parentage list of approximately 700 daffodils represents merely Calvert's list plus almost half again as many additional hybrids, chiefly of English origin. Only a few are from America and the Antipodes.

3B	Abschied	9	Poet X 3A Beacon
9	Adieu	9	Acme X 9 Poet
2A	Adventure	1A	Desperado X 2A Commander in Chief
5B	Agnes Harvey	4B	Minnie Hume X 11 Triandrus albus
1C	Agnes Montefiore	1A	Cleopatra X 7 Jonquil
3B	Agrippa	3B	Dorothy Wemys X 9 Poetarum
3B	Aida	2A	Princess Mary X 9 Poeticus
5B	Alabaster	4B	Minnie Hume X 11 Triandrus calathinus
2A	Aladdin's Lamp		Leedsii X 2A Fortune
3A	Alcida	2B	Bernardino Seedling
2B	Aled	4B	Minnie Hume X 1C Weardale Perfection
5A	Alemena	1A	Lord Roberts X 11 Triandrus calathinus
3B	Aleppo	2B	Bernardino X 3B Sunstar
3B	Algiers	3B	Forfar self-fertilized
1B	Alice Knights	1B	Madame de Graaff X 1B Cernuus
4B	Alison	4B	Nelly X Seedling
4B	Anthea	4B	Montanus X 9 Poeticus
2B	Anzio	2B	Clava X 2B Hades
1C	Apricot	1A	Abscissus X 1B Albicans
2A	Arbalist	2A	Hospodar X Seedling
1B	Ardclinis	1B	Mrs. E. H. Krelage X 1B Beersheba
5B	Ariel	4B	Minnie Hume X 11 Triandrus calathinus
4B	Arion	4A	Hera Seedling
2B	Armoy	4A	Hexagon X 3B Crimson Braid
1B	Askelon		Seedling X 1B Nevis

4A Astrid	4A	Mary Blewett X 1C Mrs. W. Joodie
1B Atalanta	1B	Madame de Graaff X Seedling
1A Auralius	1A	Renown X 1A Golden City
1B Avalanche	1B	Madame de Graaff X Seedling
Avanley	1C	Pink O'Dawn X 1B Beersheba
1B Avebury		Seedling X 1B Nevis
2A Aviemore	3A	Beacon X 2A Fortune
2A Bahram	2A	Penquite X 2A Porthilly
2B Ballyrashane		Seedling of Nissa
4A Banchory	1B	Slemish X 4A Naxos
4A Bandon	1B	Cameronian X 4A Slemish
3A Barbaric	1A	M. J. Berkeley X 9 Socrates
2A Baronet	1A	King Alfred X 2B Bernardino
4A Basilia	4A	Maggie May X 1A King Alfred
3A Basra	3A	Beacon X 2A Fortune
1A Bastion	1A	Counsellor self-fertilized
3A Beacon	2A	Princess Mary X 9 Recurvus Seedling
2B Beauty of Radnor	2B	Bernardino X 3B Dragoon
1B Beersheba	1B	White Knight X Seedling
2A Bellaghy	2A	Trevisky X 2A Fairy King
1A Ben Alder	1A	King Alfred X 1A Lord Roberts
1C Benedick	1B	Loveliness X 1A King Alfred
2A Berdas	2A	Sir Watkin X 9 Ornatus
2B Bernardi	1A	Abcissus X 9 Pyrenean Poeticus
2B Bernardino	4B	Duchess of Brabant X 2B Lulworth
6 Beryl	11	Cyclamineus X 9 Poeticus
2A Beryl Parr	1A	Yellow Trumpet X 2A Fortune
3B Blinkbonny	3B	Sunstar X 2B Hades
2B Blodwen	2B	War Flame X 2B Pink 'Un
3B Bloodstone	2B	Lulworth X 9 Horace
2A Bokhara	2A	Tamerlane X 2A Fortune
2A Bombay	2A	Diolite X 2A Marksman
1B Borealis	1B	Corinth X 4A Naxos
1C Boreas	1B	Loveliness X 1A King Alfred
7 Boskenna	2B	Pilgrim X 7 Jonquil
4A Bradwardine	1B	Nevis X 4A Tenedos
2A Braniel	2A	Hospodar X 2A Fortune
3B Bravura	2B	Folly X 3B Sunstar
2B Bread and Cheese	4A	Alburnia X 1C Sincerity
2A Breila	2A	Sir Watkin X 9 Ornatus
1C Bridal Robe	1C	Sincerity X 1B Slemish
3B Bridegroom	3A	Mozart X 2A Gallipoli
1A Broadford	1A	King Alfred X 1A Lord Roberts
2B Bronwen	4B	Minnie Hume X 1C Duke of Bedford
1B Broughshane	1C	Trostan X 1B Kanchenjunga
4A Bryn Ellen	2A	El Oro X 3A Twinkle
Bryn Orange	2B	Estelle X 2A Fortune
1A Bulwark	1A	Ben Alder X 1A Cleopatra
2B Buncrana	2A	Carbineer X 2A Porthilly

2A Butte Bowl	2A	Leontes X 1A Seahorse
7 Buttercup	1A	Emperor X 7 Jonquilla
2A Calif	2A	Hospodar X Seedling
1B Callirhoe	1C	Duke of Bedford X 1B Madame de Graaff
8 Canberra	8	Adonia (Taz.) X 1A Yellow Trumpet
4B Candle Light	4A	Alburnia X 3B The Admiral
4A Candour	1B	Quartz X 4A Naxos
1B Cantatrice	1B	Eskimo X 1B Beersheba
1A Canute	1A	Emperor X 1A King Alfred
4A Capella	4B	Minnie Hume X 1B Madame de Graaff
4B Capri	4B	Mystic X 9 Poeticus
4A Caragh	4A	Mitylene X 2A Penquite
2A Carbineer	2A	Gulliver X Seedling
1C Carmel	1C	Findhorn X 1B Nevis
1C Carmenta	1B	Peter Barr X 4A Maggie May
4B Carnalea	4B	Nelly X Silver Coin Seedling
4A Carnmoney	4B	Nelly X 2B Folly
3B Carpatica	3B	Coronach X 3B Forfar
3A Carrigart	3A	Goyescas X 2A Penquite
9 Cassandra	9	Poeticus Ornatus X 9 Poetarum
1B Catania	1C	Morven X 1B Mrs. Ernst H. Krelage
2B Centurion	1B	Madame de Graaff self-fertilized
1A Cern	1A	Maximus X 1C Duke of Bedford
4B Chamois	4B	Mrs. Langtry X 9 Cassandra
4A Chastel	4A	Cicely X 1B Beersheba
2A Cheerio	3A	Seraglio X 2A Fortune
2B Cheers	9	Kestrel X 2A Fortune
7 Cherie	7	Jonquil X 4A Lord Kitchener
1B China Clay	1C	Morven Seedling X 1B Beersheba
4B Chinese White	4B	Silver Plane X Silver Coin Seedling
8 Chinita	9	Chaucer X 8 Jaune á Merveille
1C Chit Chat	1A	King Alfred X Seedling
9 Chloride	9	Distich X 9 Black Prince
2A Christian	2A	Pilgrimage X 3A St. Egwin
7 Chryse	1A	King Alfred X 7 Jonquilla
3A Chungking	3A	Market Merry X P. D. Williams Seedling
4A Cicely	2A	Fleetwing X 1B Mrs. Robert Sydenham
1A Clarion	1A	Monarch X 1A King Alfred
2B Clava	3A	Beacon X 2B Loch Fyne
4A Cleena	2A	Fortune Seedling
1A Cleopatra	1A	Monarch X Seedling
1A Clonmel	1A	King of the North X 1A Sorley Boy
3B Clwyd	3A	Mozart X 2A Gallipoli
3A Coeur de Lion	2A	Princess Mary X 9 Poetarum
4B Columbine	9	Dactyl X 4B Mystic

2A Commander in Chief	2A Princess Mary X 1A King Alfred
2B Conbeg	2B Merryhill X 3B Sunstar
1C Consort	1C Trostan X Seedling
1B Coolin	1B Nevis X 1B Beersheba
2A Copper Bowl	3A Beacon X 2A Fortune
1B Corinth	1B Nevis X 1B Beersheba
4B Cornish Cross	3B The Sahib X 4B Mystic
2A Corregio	2B Will Scarlett X 2B Bernardino
2A Cotopaxi	2A Killigrew X 2A Penquite
4A Cotterton	1B Tain X 4A Evening
4A Courage	(1B Nevis selfed X 4A Naxos) X 1B Askelon
1C Coverack Beauty	1C Findhorn X 1B Nevis
4A Coverack Crest	2B Nissa X Seedling
2A Coverack Delight	1B White Emperor X 2A Yellow Incomp.
2A Coverack Gold	1A King Alfred X 4A Tenedos
2B Coverack Perfection	4A Mitylene X 2A Fortune
2A Coverack Sister	4A Mitylene X 2A Fortune
7 Coverack Sun	2A Pilgrimage X 7 Jonquilla
3B Cresset	2A Princess Mary X 9 Poetarum
3B Crete	3A Seraglio X 3B Sunstar
3B Crimson Braid	9 Poeticus verus of Linnaeus X 2B Will Scarlett
1A Cromarty	1A Hebron X 1A Alchemist
3B Crown Derby	4A White Sentinel X 3B Sunstar
2B Crusader	2A Princess Mary X 9 Poetarum
4A Culmore	4B Nelly X Seedling
4B Cushendall	4B Emerald Eye X 9 Dactyl
4B Cushlake	4B Fairy Circle Seedling
6 Cyclataz	11 Cyclamineus X 8 Soleil d'Or
1C Cygnet	1A Monarch X 1B Madame de Graaff
4A Czarina	2A Sir Watkin X 1C Weardale Perfection
9 Dante	9 Ornatus X 9 Poetarum
1A Darius	1C Grandee X 1A Emperor
4A Dava	2B Nissa X 1B White Emperor
1B Dawnglow	1C Rosary X 1C Pink O'Dawn
4A Denys Meyer	2B Bernardino X 1C Seedling
Derek Meyer	4B Walter Fitch X 1A Golden Emperor
2A Dervish	2A Fortune X 2A Cornish Fire
2A Derwin	2A Sir Watkin X 9 Ornatus
1A Desperado	1A King Alfred X 1A Harvest (Back-house)
4A Devenagh	4A Niphetos X 1B Scapa
3B Dieppe	3B Coronach X 3B Forfar
3A Dinkie	2A Princess Mary X 3B Crimson Braid
5B Dione	4B Minnie Hume X 11 Triandrus calathinus
9 Discoed	9 Almira X 2B Will Scarlett

9	Ditty	.....9	Socrates X 9 Acme
4A	Diva	.....	Seedling X 4A Naxos
5A	Dorothy Kingsmill	.....1C	Grandee X 11 Triandrus
2A	Downas	.....3B	Sunstar X Seedling
4B	Dreamlight	.....9	Dactyl X 4B Mystic
1B	Dropmore	.....1A	Monarch X 1B Madame de Graaff
10	Dubloon	.....10	Telemonius plenus X 9 Ornatus
4B	Duchess of Brabant	.....4B	Minnie Hume X ?
1A	Duke of Kent	.....1B	Madame de Graaff X 1A Monarch
4A	Dulsie	.....1B	Everest X 1B White Emperor
2A	Dunkeld	.....3A	Seraglio X 2A Killigrew
4A	Dunlewey	.....4A	Mitylene X 1B Kantara
4A	Dunloe	.....4A	White Sentinel self-fertilized
4A	Dunseverick	.....4A	Still Waters X 4A Dava
1A	Durbar	.....1C	Glory of Noordwijk X 1A Cleopatra
4A	Earl Grey	.....1A	Emperor X 11 Triandrus Albus
4A	Early Morn	.....2B	Leslie Hulbert X 2A Fortune
9	Elegy	.....9	Horace X 9 Almira
4A	Elfrida Pearson	.....4B	Minnie Hume X 1B Madame de Graaff
2A	Ellangowan	.....2A	Killigrew X 3A Marquis
3B	Emerald	.....4B	Montanus X 9 Poeticus var.
4B	Endymion	.....4B	Minnie Hume X 9 Poetarum
1B	Epicure	.....1B	White Emperor self-fertilized
1B	Eskimo	.....	Leedsii X 1B Mrs. E. H. Krelage
4A	Ettrick	.....2B	Pilgrim X 1B Mrs. Robert Sydenham
1B	Everest	.....	Leedsii Seedling X 1B Mrs. Robert Sydenham
2B	Fair Edith	.....1A	Hon. Mrs. Jocelyn X 9 Poeticus
1B	Fairy Dream	.....1B	Nevis X 1B Beersheba
2A	Fairy King	.....2A	Gulliver seedling
7	Fairy Nymph	.....4A	Maggie May X 11 Jonquil
10	Falaise	.....10	Mary Copeland X Poeticus (?)
4A	Falcon	.....4B	Mrs. Langtry X 9 Poeticus
4A	Fanny Currey	.....4A	Lord Kitchener X 2B Bernardino
6	February Gold	.....11	Cyclamineus X 1A Golden Spur
2B	Fermoy	.....4A	Niphetos X Red & White Seedling
3B	Fidelia	.....4B	Montanus X 9 Poeticus
1C	Findhorn	.....1B	Madame de Graaff X 2B Lady Margaret Boscawen
2A	Fireflame	.....1A	Tenby Daffodil X 9 Poetarum
2A	Firelight	.....1A	Tenby Daffodil X 9 Poetarum
2B	Firewater	.....4B	Nelly X 3B Hades
2B	Flamenco	.....2A	Hospodar X 3B Sunstar
9	Flare	.....9	Bloodstain X Ecstasy
4B	Flora	.....3B	Flora Wilson X 2B Lulworth
1C	Florence Pearson	.....1A	Emperor X 1B Madame de Graaff
1A	Florists' Delight	.....1A	Monarch X 1A King Alfred
3B	Florizel	.....2B	Lulworth X 9 Horace
1B	Flushing	.....1B	White Trumpet Seedling X 1B Beersheba

1C Foresight	1C	Bonython Seedling
3B Forfar	3A	Beacon X (2A Fortune X 3B Sunstar)
1A Fortress	1A	King of the North X 1A Sorley Boy
3B Fortunatus	9	Kestrel X 24 Fortune
2A Fortune's Beacon	3A	Beacon X 2A Fortune
2A Fortune's Beauty	2B	Bernardino X 2A Fortune
2A Fortune's Blaze	2A	Fortune X 2A Gulliver
2A Fortune's Cheer	2A	Fortune X 3B Robin Redbreast
2A Fortune's Circle	3A	Seraglio X 2A Fortune
2A Fortune's Crown	2A	Tamerlane X 2A Fortune
2A Fortune's Ensign	2A	Fortune X 2B Galopin
2A Fortune's Flag	2A	Knipp X 2A Fortune
2A Fortune's Flame	2A	Killigrew X 2A Fortune
2A Fortune's Glow	3A	Mozart X 2A Fortune
2A Fortune's Hope	3A	Red Sea X 2A Fortune
2A Fortune's Pride	3A	Beacon X 2A Fortune
2A Fortune's Smile	3A	Mozart X 2A Fortune
1B Fountain	1B	Eskimo X 4A Tenedos
3B Frailty	4B	Montanus X 9 Poeticus
2A Franklin	2A	Havelock X Seedling
4B Frigid	4B	Emerald Eye X 9 Dactyl
1A Frontier	1A	King of the North X 1C Content
2A Gaiety	1A	Hon. Mrs. Jocelyn X 9 Poeticus
2B Gala	2B	Folly X 2B Red Abbott
3B Galata	3A	Mozart X 2A Gallipoli
2A Galliard	2A	Calif X Seedling
2A Gallipoli	2B	Bernardino X 2B Will Scarlett
2A Galway		Thought to be 2A Fortune X 2A Corcus
2A Garibaldi	2A	Hospodar X Seedling
2A Garland	3A	Seraglio X 2A Copper Bowl
2B General Sarraill	4A	Maggie May X 1C Weardale Perfection
1B Georgina Clogstoun	1A	Hamlet X 1B White Knight
2A Gibraltar	2A	Carbineer Seedling
4B Gilt-edge	4B	Moonbeam X 9 Allan-a-Dale
4A Girdle	4B	Minnie Hume X 1C Weardale Perfection
2B Glad Eye	9	Poeticus verus X 2B Will Scarlett
4A Glenarm		(Leedsii X 1B Mrs. R. Sydenham) X 4A Tenedos
2B Glendwin	2B	War Flame X 2B Pink 'Un
1C Glenravel	1B	Mrs. E. H. Krelage Seedling
5B Gloaming	4B	Minnie Hume X 11 Triandrus albus
1A Glory of Leiden	1A	Abcissus X Trumpet
2B Golconda	1A	Lord Roberts X 3B Fireball
1A Goldbeater	1A	Maximus Self-fertilized
1A Goldcourt	2A	Crocus X 1A Cromarty

2B Gold Crown	1B	Nevis X 2A Fortune
1A Gold-Digger	2A	Crocus X 1A Cromarty
6 Golden Arrow	1A	Monarch X 11 Cyclamineus
1A Golden Cross	1C	Morven X Seedling
1A Golden Emperor	1A	Lord Roberts X 1A King Alfred
1A Golden Flag	1A	Monarch X 1A King Alfred
1A Golden Hind	1A	Hebron X 2A Crocus
1A Golden Melody	1A	Royalist X 1A Godolphin
7 Golden Model	1A	Monarch X 7 Jonquil
1A Golden Monarch	1C	Weardale Perfection X C. H. Curtis
1A Golden Sand	1A	King Alfred X 1C Glory of Noordwijk
1A Golden Wealth	1A	Hebron self-fertilized
2A Golden Wedding	1B	White Emperor Seedling
1A Gold Mark	1A	Hebron X 7 Solleret
2A Gold Reef	2A	Leontes X 1A Seahorse
1A Golford	1A	Hebron X 1A Yukon
2A Good Cheer		(2A Fortune X 3A Gulliver) X 2A Ruston Pasha
2A Goodwill	2A	Copper Bowl Seedling
2A Granada	2A	Hospodar X Seedling
9 Grand Opera	9	Kestrel X 3A Seedling
4B Gray Lady	9	Dactyl X 4B Mystic
4A Grayling	4A	The Fawn X 1A Maximus
2B Great Warley	1C	Horsfieldii X 9 Ornatus
5A Greek Slave	1A	Cleopatra X 11 Triandrus calathinus
3B Greenheart	8	Bilflorus X 9 Poeticus
4A Green Island	4A	Gracious X 3A Seraglio
4A Guardian	4A	Niphetos X 1C Trostan
1A Guinea Gold	1A	Glory of Leiden X 2B Nelsoni auran- tius
2B Gunthorpe Belle	2B	Will Scarlett X 4A Alfrida Pearson
1C Halfa	1A	Queen of the West X 1B White Em- peror
1A Hatfield Beauty	1B	Madame de Graaff X 1A Monarch
1A Hebron	1B	White Emperor X 1A King Alfred
4B Helston	1B	White Emperor Seedling X 9 Ring- dove
1B Henri Vilmorin	1A	Monarch X 1B Madame de Graaff
9 Herrick	9	Ornatus X 9 Poetarum
4A Hexagon	1B	Madame de Graaff X 4 Leedsii Seed- ling
1C Hiltruda	1B	Madame de Graaff X 4A White Queen
1A His Excellency	1A	King Alfred X 19 Honey Boy
2B H. M. Queen Alexandra ...	4B	Minnie Hume X 1C Weardale Perfec- tion
1A Hirlas	1A	Maximus X 1A Henry Irving
4A Holmdale	1B	Phantasy X 4 Giant Leedsii
1A Honey Boy	1B	Madame de Graaff X 1A King Alfred
2A Hong Kong	2A	Fortune X 2A Penquite

1C Honour	4A	Empire X 1B Miss Clinch
2A Hopeful	2B	Bernardino X 1A King Alfred
9 Horace	9	Orantus X 9 Poetarum
1C Horsfieldii		Lent Lily (Pseudo Narcissus) X small bicolor
2A Hospodar	3B	Firebrand X 1A King Alfred
3B Huesca	3B	Kaffir X 9 Dactyl
1A Hunter's Moon	1A	Brimstone X 1A Moongold
4A Imbros	4B	Minnie Hume X 4A Lemon Star
2B Inamorata	1A	King Alfred X 4B Minnie Hume
2A Indian Summer	3A	Market Merry X 2A Clackrattle
2B Innisfallen	1B	White Emperor X 4A Gracious
4A Interim	4B	Cushlake X 4A Dava
2A Invergordon	3B	Therapia X Seedling
2A Inverness	3A	Seraglio X 2A Fortune
1C Iolanthe	4A	Czarina X 1B Peter Barr
4A Irish Pearl	4B	Minnie Hume X 1B Pearl of Kent
1A Irish Prince	1A	Goldbeater X 1A Belshazzar
4A Ischia	2B	Penwith X 4A Suda
1A Isolde	1C	Weardale Perfection X 1B Madame de Graaff
4B Ivorine		Seedling X 2B Lulworth
2A Jalna	2A	Granada X Seedling
9 James Hogg	9	Oliver Goldsmith X 9 Hildegarde
1C J. B. M. Camm	1B	Albicans X 1C bicolor of Haworth
1A Jhelum	1A	King Alfred X 1A Cleopatra
3A John Peel	3B	Dorothy X 3B Sheba
5 J. T. Bennett-Poe	1A	Emperor X 11 Triandrus albus
1A Juryman	1A	Hebron X 2A Crocus
4A Justice	1B	Quartz X 4A Naxos
3B Kairouan	2B	Folly X 3B Sunstar
1B Kanchenjunga	(1B	Conqueror X 1B White Knight) X 1B Askelon
1A Kandahar	1A	Ben Alder X Yellow Ajax
Karanja		Rene Seedling X 1B Dawnglow
4A Kencott	4A	White Sentinel self-fertilized
4A Kenmare	4A	White Sentinel self-fertilized
Kensale	4A	White Sentinel self-fertilized
2A Khamseen	2A	Calif X Seedling
2A Kilbride	2A	St. Egwin X 2A Penquite
1A Kildare	1A	Royalist X 2A Crocus
2A Kilfinnan		Stirling X 2A St. Egwin
2B Kilimanjaro	2B	Clava X 3B Hades
1A Kilkenny	1A	Royalist X 2A Trenoon
8 Killara	8	Grand Monarque X 1C Empress
2A Killinchy	3A	Market Merry X 2A Porthilly
2A Kilrush		Stirling X 2A St. Egwin
2B Kilworth	4A	White Sentinel X 2B Hades

1A King Alfred	1A	Emperor X 1A Maximus
3B King George V	9	Ornatus X 2A Gloria Mundi
9 King of Diamonds	9	Dactyl X 9 Ace of Diamonds
1A King of the North	1A	King Alfred X 1C Glory of Noord- wijk
1A Kingscourt	1A	Royalist X 2A Crocus
9 Knave of Diamonds	9	Dactyl X 9 Ace of Diamonds
1C Knight Errant	1A	Monarch X 1B Madame de Graaff
1A Knockboy	1A	King of the North X 1A Sorley Boy
4A Konia	3B	Albatross X 1B Mrs. Robert Syden- ham
2B Kopriva		Barrii X 2A Fortune
2A Krakatoa	2A	Garibaldi X 2A Fortune
2A Kwasind	1A	van Waveren's Giant X 2A Romance
4A Lady Betty		Seedling X 1B White Knight
2A Ladybird	1A	Tenby Daffodil X 9 Poetarum
1B Lady Kenyon	1B	Madame de Graaff X 1C Weardale Perfection
1C Lady Mine	2B	Great Warley X 1A van Waveren's Giant
1B Lady Warren	1C	Weardale Perfection X 1B Madame de Graaff
2B La Tosca	2B	Bernardino X 9 Poeticus
4B Laughing Water	4B	Minnie Hume X 2B Stella Superba
1A Leinster	1A	King of the North X 1A Sorley Boy
4B Lemon Frill	2B	Mabel Cowan X 2B Lulworth
1A Lemon Giant	1C	Florence Pearson X Giant Leedsii
1A Lemonora	1B	Corinth X 4A Naxos
2A Leontes	3A	Beacon X 1A Lord Roberts
1B Le Phare	1B	White Knight X 4A Tenedos
2B Leslie Hulbert	1B	Seedling X 2B Lucifer
1B Levant	4A	Tenedos X 1B White Knight
1C Le Voleur	1A	Cleopatra X 1B White Knight
4A Lido	4A	Imbros X 4A Tenedos
9 Lights Out	9	Dactyl X Engleheart Poet
4A Lily of Rotherside	4A	Lowdham Beauty X 3B Crimson Braid
3B Limerick	2B	Folly X 2B Hades
2B Linn	2B	John Evelyn X 2A Fortune
4A Lisbreen	4A	Mitylene X 4A Evening
1B Lizard	1B	Mrs. Krelage Seedling X 1B Beer- sheba
10 Llilnos	3A	Beacon X 10 Telamonius plenus
2B Loch Fyne	4B	Minnie Hume X 2B Lady Margaret Boscawen
3B Lone Star	4B	Montanus X 9 Poeticus
4A Lord Kitchener	4B	Minnie Hume X 1C Weardale Per- fection

1A Lord Roberts	1A Monarch X	1B Madame de Graaff
4A Louise L. Linton	4B Minnie Hume X	1B Madame de Graaff
1B Loveliness	1B Madame de Graaff X	Seedling
4A Lowdham Beauty	4B Minnie Hume X	1B Madame de Graaff
2B Lucifer	1C Princepts X	9 Poetarum
5B Lucinda	3B Albatross X	11 Triandrus calathinus
Luther	Mary Blewitt X	4A Imbros
1B Madame de Graaff	1B Albicans X	1C Empress
1C Madame Plemp	1C Empress X	Seedling
2A Magherally	Seedling of Fairy King	
4A Magnolia	4A Felspar X	4A Empire
1C Maharajah	1C Victoria X	1C Weardale Perfection
3B Mahmoud	2B Folly X	3B Sunstar
1B Maiveroe	1B Quartz X	1B Beersheba
1B Manacles	1B Nevis Seedling X	4A Naxos
3B Mandalay	3B Harold Finn X	3B Ethelbert
1C Manna	1A Cleopatra X	1B White Knight
1A Maraval	1A King of the North X	1C Content
3A Market Merry	3A Seraglio X	(2A Tamarlane X 2A Fortune)
2A Marksman	2A Hospodar seedling	
4A Marmora	4B Minnie Hume X	1B Mrs. E. H. Krelage
2B Marshlight	1C Princeps X	9 Poetarum
4A Martello	Seedling X	1B Nevis
10 Mary Copeland	9 Poet X	10 Orange Phoenix
8 May Dew	8 biflorus X	9 poeticus
4A May Fisher	4B St. Olaf X	1B Mrs. E. H. Krelage
2B Mazeppa	2B Warlock X	Seedling
1A Mellow	1A Cleopatra X	Seedling
5B Melusina	3B Albatross X	11 Triandrus calathinus
9 Memory	9 Almira X	9 Horace
2A Mexico	3A Alight X	2A Rustom Pasha
1A Milanion	Seedling X	1A Royalist
4B Minnie Hume	1B Albicans X	9 Poeticus augustifolius
9 Minuet	9 Kingsley X	9 Socrates
3A Miramar	3A Beacon X	3B Sunstar
4A Miss E. M. Bowling	4B Anthea X	4A Lord Kitchener
3B Miss Willmott	9 Ornatus X	2A Gloria Mundi
4B Misty Moon	4B Mystic X	?
4A Mitylene	3A Beacon X	Leedsii Seedling
1A M. J. Berkeley	1A Maximus X	?
4B Moina	4B Mystic X	2B Pink 'Un
4B Moonbeam	Mrs. Barton X	9 Recurvus
1B Moray	1B Nevis X	4A Tenedos
3B Morocco	9 Hildegarde X	3B Oiseau de Feu

1C Morven	1C	Victoria X 1B Madame de Graaff
4A Moville	4B	Nelly X 4A Banchory
3A Mozart	2A	Princess Mary X Seedling
3B Mr. Jinks	2B	Bernardino X 3B Sunstar
1B Mrs. D. V. West	1C	Weardale Perfection X 1B Madame de Graaff
1B Mrs. Ernst H. Krelage	1A	King Alfred X 1B Madame de Graaff
1B Mrs. G. H. Barr	1B	Madame de Graaff X Seedling
1B Mrs. Lower	1A	Cleopatra X 1A Clarion
4B Mrs. Nette O'Melveny	4A	Hera Seedling
4A Mrs. R. O. Backhouse	4A	Lord Kitchener X Red Cup seedling
1B Mrs. Robert Sydenham	1B	Madame de Graaff X Seedling
10 Mrs. William Copeland	4A	Venus X pale double
3A Music	4B	Mrs. Langtry X White Trumpet
2A Mylor	2A	Pilgrimage X 1A Royalist
4B Mystic	4B	Miss Weisse X Poet
4A Namos	4A	Niphetos X 1B Kanchenjunga
2A Nancy Cumberlege	2B	Bernardino X 2A Fortune
2A Narvik	2A	Carbineer X 2A Porthilly
1B Neuralia	1B	Mrs. Robert Sydenham X 1C Conqueror
4A Nevin	4B	Minnie Hume X 1C Weardale Perfection
1B Nevis	1A	King of the North X White Ajax
2A Newlyn	4A	White Sentinel X 24 Gallipoli
1B Nilkanta	1B	Kenbane X 1B Kanchenjunga
2B Nissa	4A	Kingdom self-fertilized
4A Nocturne	4A	Marmora X 4A Evening
4A Norah Pearson	4B	Minnie Hume X 1B Madame de Graaff
2B Novelty	2B	Lulworth X 9 Poeticus
2A Nutwith	2A	Hospodar X Seedling
3B Nysa	2B	Lulworth X 9 Horace
3B Olivia	2B	Lulworth X 9 Horace
6 Orange Glory	1A	Yellow Trumpet Seedling X Cyclamineus
3B Ortona	4A	Mitylene X 3B Coronach
2A Osiris		Princess Mary Seedling X 1A King Alfred
4A Oslo	4B	Nelly X 1B Beersheba
2B Palma	2A	Princess Mary X 2A Gallipoli
3B Pandora	2B	Lulworth X 9 Horace
2A Paramount		Seedling X 3B Crimson Braid
4A Parkmore	4A	Niphetos X 1B Scapa
4B Paulette	4A	Maggie May X 9 Recurvus
5B Pearl of Dew	3B	Albatross X 11 Triandrus calathinus
1B Pearl of Kent	1A	Monarch X 1B Madame de Graaff
1C Peeress		Weardale Perfection Seedling X 1B Carmel

2A Peiping	2A	Carbineer X 2A Porthilly
2A Pendeen		Beacon Seedling X 2A Fortune
3B Penhallick	3B	Harpagon X 3B Sunstar
2B Penwith	4A	Tenedos X 2A Fortune
4B Penzance	1B	Kantara X 4A Naxos
3B Pera	3A	Beacon X 3B Sunstar
1A Persia	1A	Sorley Boy X Seedling
1B Peter Barr	1A	Monarch X 1B Madame de Graaff
8 Peter Lower	3B	Yeoman of the Guard X 3B Mandalay
2A Petrocleus	1A	King Alfred X 1C Weardale Perfection
3B Petrinia	2A	Princess Mary X 9 Horace
1B Petsamo	3A	Niphetos X 1B Kanchenjunga
1C Phyllis Vansittart	1B	Madame de Graaff X 1C Weardale Perfection
2A Pilgrimage	2B	Pilgrim X Broadford
2A Pilgrim Father	2B	Pilgrim X 1A Ben Alder
4A Pinkeen	1	Okapi X 4A Tenedos
4A Pinkie (Radcliff)	2B	Pinkeen X 1C Mrs. Moodie
1C Pink O'Dawn	4A	Lord Kitchener (?) X 1C Mrs. Moodie
2A Playboy		Carbineer seedling
8 Pleiades (Poetaz)	3B	Adonia X 9 Ornatus
2B Pleione	2B	Lulworth X 9 Horace
8 Poetaz (van der Schoot)....	11	Tazetta X 9 Poeticus ornatus
3B Polcoverack	3A	Mozart X 3B Sunstar
4A Poldhu	4A	Imbros X 4A Tenedos
5B Polydorus	3B	Albatross X Triandrus calathinus
5A Polyxena	1C	Weardale Perfection X 11 Triandrus calathinus
3A Primrose Dame	1A	Hon. Mrs. Jocelyn X Poeticus
9 Prince of Poets	9	Raeburn X 9 Dactyl
5A Princess Ena	1C	Grandee X 11 Triandrus albus
2A Princess Victoria	2A	Sir Watkin X 9 Ornatus
1A Principal	1A	Cleopatra X 1A Sorley Boy
2B Promptitude	4A	Gracious X Seedling
3A Punchinello	2A	Hospodar X 3B Sunstar
4A Puritan Maiden		Giant Leedsii X 1C Florence Pearson
1C Pyramus	1C	Weardale Perfection X 1B Madame de Graaff
1B Quartz	1C	Morven X 1B White Emperor
1C Queen of Beauty	1A	Lord Roberts X 1B Loveliness
9 Queen of Diamonds	9	Dactyl X 9 Ace of Diamonds
5A Queen of Spain	1A	Santa Maria X 11 Angel's Tears
1C Queen of Ulster	1A	Darius X 1C Weardale Perfection
3B Quetta	2B	Bernardino X 3B Crimson Braid
1A Racehorse	1A	King Alfred X 1A Monarch
9 Recessional	9	Socrates X 9 Lullaby

2A Red Cross	Seedling X 2B Will Scarlet
2A Red Dragon	1A Hon. Mrs. Jocelyn X 9 The Bride
2B Red Hackle	2B Folly X 2B Red Abbott
3B Redpole	3B Yeoman of the Guard X 9 Black Prince
2A Red Riband	3A Seraglio X 2A Fortune
3B Red Riding Hood	2B Lulworth X 9 Horace
3A Red Sea	3A Beacon X 2B Will Scarlett
2A Regent	9 Kestrel X 2A Fortune
2B Rewa	2B Bernardino X 2A Fortune
1C Richard Strauss	1C Grandee X 11 Triandrus albus
4A Riva	2B Bernardino X 1C Rosary
3B Robin	3A Beacon X 9 Dactyl
1A Rolled Gold	1A Goldbeater X 24 Penbeagle
Rosario	4A Pinkie X 1C Rosary
4A Roselands	4A Pinkie X Luther
4A Rose of Tralee	4A White Sentinel self-fertilized
Roslyn	1B Dawnglow X Rosario
2A Rouge	2A Killigrew X 2A Cornish Fire
1A Royalist	1A Cleopatra X 1A Broadford
3B Ruby	2B Lulworth X 9 Horace
1B St. Mary	1B Quartz X 4A Diva
3B St. Ninian	3B Nairn X 2A Killigrew
4B St. Senara	2A Princess Mary X recurvus
4B Samaria	3 Barrii Seedling X 4B Moonbeam
2A Samarkand	1A Ben Alder X 2A Fortune
1B Samite	1B Mrs. Ernst H. Krelage X 1B Beer-sheba
7 Sanda	1A King Alfred X 7 Rugulosus maximus
2B Santiam	2B John Evelyn X 2A Fortune
1B Scapa	1B Quartz X 4A Tenedos
2A Scarlet Pimpernel	1A Henry Irving X 9 Poeticus
4A Scarva	4A Mitylene X 2A Fortune
2B Scoutmaster	1A King Alfred X 4B Minnie Hume
2B Seabank	White Ajax Seedling X 3B Hades
4A Sea Urchin	4A White Nile X 4A Tenedos
3A Seraglio	3A Mozart X 2A Gallipoli
1A Seraphine	1C Weardale Perfection X 1B Cernuus
3 Serapis	2B Lulworth X 9 Horace
1A Severn	1B White Knight X 1A Royalist
2B Seville	Seedling X 2B Lulworth
9 Shanach	Dactyl Seedling
1B Sheeroe	1B Madame de Graaff X Seedling
4A Shining Waters	4A Marmora Seedling
5B Shirley	2B Lady Margaret Boscawen X 11 Triandrus calathinus
3B Shrove	2A Princess Mary X 9 Horace
5B Silver Chimes	8 Scilly White X 11 Triandrus albus

5B Silver Dew	4B Minnie Hume X 11 Triandrus calathinus
4B Silver Moon	9 Poeticus X 9 Poeticus biflorus
4B Silver Salver	4B Moonbeam X 9 Poeticus
4B Silver Spangle	2B Lulworth X 9 Horace
5B Silver Swan	4B Minnie Hume X 11 Triandrus calathinus
4A Silver Wedding	1C Halfa X 1B Beersheba
2B Simla	2B Bernardino X 2B Seville
1C Sincerity	1A Lord Roberts X 1B White Knight
2B Sirius	1C Princeps X Poetarum
1B Slemish	1C Findhorn X 1B Beersheba
9 Smyrna	9 James Hogg X 9 Ace of Diamonds
4A Snow Crest	4B Montanus X 9 Poeticus
1B Snow Crown	1B White Emperor X 1B Beersheba
5B Snow Nymph	3B Albatross X 11 Triandrus calathinus
9 Sodium	9 Acme X Poeticus
4B Songster	1B Mrs. Thomson X 9 Ornatus
1A Sparta	1B White Emperor X 1B White Maximus
5 Spindrift	4B White Lady X 11 Triandrus albus
1A Spread Eagle	1A Hon. Mrs. Jocelyn X 9 Poeticus
4A Stability	2A Princess Mary X 1C Vestal Virgin
2A Stella Tid Pratt	Seedling X 2B Will Scarlett
Stirling	3A Beacon X (1A X 2A Pilgrimage)
2A Stout Lad	Faithful Seedling
4A Suda	1B Nevis X 4A Lord Kitchener
1A Sulphur Prince	1A Ben Alder X 1B White Knight
1A Sultan	1A Cleopatra X 1A Darius
2A Sun Chariot	2A Porthilly X 2A Rustom Pasha
2A Sun Dance	1A Magnificence X 2A Fortune
2A Sunkist	9 Dactyl X 4B Mystic
1C Sunshine	1A Glory of Leiden X 2B Nelsoni aurantius
3B Susette	2B Lulworth X 9 Horace
2B Suvla	Seedling from Minnie Hume X Incomp. X Leedsii Seedling
10 Swansdown	4A Mitylene X 9 Poeticus Smyrna
2A Swashbuckler	1A King Alfred X 4B Minnie Hume
4B Sweet Nell	4A Maggie May X 9 Poeticus recurvus
4B Sylvia O'Neill	4B Silver Plane X Silver Coin Seedling
1C Tain	1B Beersheba X (? X Beersheba)
2A Tamerlane	3B Firebrand X 1A King Alfred
2A Tamino	3A Tredore X 2A Penquite
3B Tampico	2B Warlock X 3B Forfar
9 Tannahill	9 Dactyl X 9 Ace of Diamonds
4A Tantalus	4B Minnie Hume X 1C Weardale Perfection

1C Tapin	1A Cleopatra X 1B White Knight
2B Taranto	2B Great Warley X 1B Mrs. Ernst H. Krelage
2A Tashkend	1A Ben Alder X 2A Fortune
3B Teresa	2B Lulworth X 9 Horace
2B The Czar	2A Gaiety X 1A Lord Roberts
4A The Fawn	4B Minnie Hume X 1C Weardale Perfection
3B The Geisha	2B Lulworth X 9 Horace
3B Therapia	3A Mozart X 2A Gallipoli
4A Thira	4A Kingdom X 1B White Emperor
1A Thoroughbred	1A King of the North X 1A Sorley Boy
4A Tibet	4A Tunis X 1B Askelon
1A Tiernan	1B Madame de Graaff X 1A Monarch
2A Tinker	2A Damson X 2A Rustom Pasha
3B Tinkle Bell	8 Biflorus X 9 Poeticus
4B Tinsel	4B Silver Plane X Silver Coin Seedling
4A Tintagel	1B Nevis X 4A Tenedos
3B Titania	4A Maggie May X 9 Recurvus
3B Topsy	2B Lulworth X 9 Horace
2B Torso	9 Almira X 2B Will Scarlett
1B Trappist	1B Mrs. H. D. Betteridge X 1A King Alfred
Treasure Island	4A Hera X 3B Sunstar
1A Tresserve	1A Golden Spur X 1A Emperor
4A Trevose	1B White Emperor X Seedling
5A Trimon	11 Bulbocodium monophyllum X 11 Triandrus albus
10 Triplex	4B Moonbeam X Poeticus
1C Trostan	1A King Alfred X 1B Askelon
4A Truth	4A Naxos X Seedling
4A Tryst	Silver Coin X 2B Armoy
2A Tuscan	2A Fleetwing X 2A Hospodar
Utopia	1A Pickwick X 9 Ornatus
1B Valetta	1C Morven X 4 Loch Lomond
5A Vanora	1B Lady Audrey X 11 Triandrus calathinus
1A van Waveren's Giant	1C Empress X Seedling
3A Varna	3A Beacon X 2A Fortune
2A Vedette	3A Beacon X Yellow Trumpet
4A Vega	4B Minnie Hume X 1B Madame de Graaff
5B Venetia	4B Minnie Hume X 11 Triandrus calathinus
1C Vestal Virgin	1B Madame de Graaff X 1C Weardale Perfection

5A	Vintage	1A	King Alfred X 11 Triandrus calath-
			inus
3B	Viola	2A	Princess Mary X 9 Horace
9	Virgil	9	Poeticus ornatus X 9 Poetarum
2A	Vladimir	2A	Gaiety X 1A Lord Roberts
2B	Vogue	4A	Lowdham Beauty X 3B Crimson
			Braid
4A	Volga	1B	Cameronian X 4A Slemish
2B	Warlock	9	Chaucer X Leedsii Seedling
1B	Whirlwind	1B	Beersheba X 1B Kanchenjunga
1B	Whitebridge	1B	Corinth X 4A Naxos
5A	White Cloud	4B	Minnie Hume X 11 Triandrus cal-
			athinus
1B	White Emperor	1C	J. B. M. Camm X 1B Madame de
			Graaff
1B	White Glory	1C	Vestal Virgin X 1B Nevis
4A	Whitehouse	2B	Nissa X 4A Tenedos
2A	Whiteley Gem	2A	Hospodar X 2A Fortune
4A	White Maiden	4A	Felspar X 1B White Knight
5	White Model	1A	Defiance X 1B Madame de Graaff
4A	White Nile	4B	Laughing Water X 1B Mrs. Robert
			Sydenham
4B	White Owl	8	Scilly White X 4B Minnie Hume
4A	White Queen	4B	Minnie Hume X 1B Madame de
			Graaff
5	White Rose (Backhouse) ..	4B	Minnie Hume X 11 Triandrus cal-
			athinus
4A	White Sentinel	3A	Beacon X Leedsii Seedling
3B	Wildfire	2A	Princess Mary X 2A Gloria Mundi
4A	Wild Rose	4A	Mitylene X 4A Evening
1C	William Baylor Hartland ..	1C	Ione X 1C Horsfieldii
2B	Will Scarlett	1A	Muticus X 9 Poetarum
1A	Winkfield's Dower	1A	King Alfred X 1A Lord Roberts
2A	Yellow Moon	2A	Jubilant X 3A St. Egwin
	Zania	4A	White Sentinel X 2A Killigrew
	Zelza	3A	Varna X 2A Porthilly
3	Zera	2B	Lulworth X 9 Horace
1B	Zero	1B	White Frost X 4A Naxos
	Zipper	4A	Mitylene X 3B Sunstar
	Zulu	4A	Mitylene X 3B Sunstar
	Zuni	4A	Hera X 3B Sunstar

REVIEW OF THE GENUS HABRANTHUS

J. C. TH. UPHOF

The genus *Habranthus* was established by William Herbert (Amaryllidaceae, 156-170. 1837.). He recognized 22 species, and a number of varieties, which up to the present, with some further additions and eliminations of other species, have been reduced to 11 species, including one recently described, *Habranthus juncifolius* Traub & Hayward (Herbertia 12 (1945): 40-41. 1947.).

Baker (Jour. Bot. 7: 79-85, 1878) reduced the genus *Habranthus* to a subgroup (with 9 species) of the genus *Amaryllis* Linn. (under the synonym, *Hippeastrum* Herb.). However, Stapf (Curtis's Bot. Mag. t. 9126. 1926.), again restored the subgroup to generic rank. Sealy (Jour. Roy. Hort. Soc. 62: 195-209. 1937) verified the work of Stapf, and furnished an excellent diagnosis of the genus *Habranthus* Herb. Sealy's diagnosis is quoted below.

The practical gardener is as a rule not familiar with such developments, and the purpose of this brief review is to provide him with this information. There should no longer be any excuse for listing *Habranthus robustus*, for instance, under *Zephyranthes* in American trade catalogs. *Habranthus brachyandrus* however, is usually listed correctly.

Genus HABRANTHUS Herbert, emend. Sealy, 1937.

Spathe tubular and sheathing below, upwards free, unilateral and usually bifid but sometimes only partly split along the back and occasionally entire; peduncle normally one-flowered, sometimes two-flowered, very rarely up to four-flowered; bracts sometimes present, sometimes absent; flower oblique to declinate; perianth tube short; segments sub-similar or of four different sizes; stamens declinate; fasciculate, unequal, of four different lengths; stigma trifid, or capitate and trilobed.

The eleven species recognized in the present paper are native to temperate South America, e.g., Argentina, Uruguay and adjacent Paraguay and Brazil. One species is native to Texas.

1. HABRANTHUS TEXANUS Herb.

Habranthus Andersoni var. *texanus* Herb. Pl. 3596 Curtis's Bot. Mag. 1837. Herbert Amaryllidaceae. 168, 1837. *Atamasco texana* (Herb.) Greene; *Zephyranthes texana* (Herb.) Baker, Amayll. 33, 1888.

DESCRIPTION.—Bulb small subglobose, 1.5 to 2 cm. in diameter, neck 2.5 to 3 cm. long. Leaves 3 to 4, narrow linear, few, thick and firm, 5 to 10 cm. long. Scape slender, 10 to 20 cm. long, 1-flowered, terete. Spathe 2.3 cm. long. Perianth 2.5 cm. in length, yellow to copper colored, striped with purple on the outside; segment lobes cuneate, acute, 5 to 6 mm. wide. Capsule 1 cm. thick, 3-lobed.

NOTES.—Native to different parts of the state of Texas where this species is widespread, growing along gravelly hillsides, prairies, mesquite flats and sometimes on waste places, growing singly or in small patches. Bulbs are buried several cm. below the surface of the ground. It is called Copper Lily, Stagger Glass or Atamasco Lily.

This is probably only a variety of *Habranthus Andersoni* as indicated by the quotation from Curtis's Bot. Mag. t. 3596, under the following species.

2. HABRANTHUS ANDERSONI Herb. ex Lindl. Pl. 1345 Edward's Bot. Reg. 1830.

DESCRIPTION.—Bulb small, obovate, dark colored. Leaves narrow, linear. Scape one-flowered. Spathe bifid., light green below, upper part whitish; lower $\frac{2}{3}$ tubular. Peduncle 2 dm. long. Perianth yellowish, darker striped, 3 to 3.5 cm. long; perianth tube 3 to 4 mm. in length and 2 mm. wide; lobes of the perianth 2 cm. wide; apex pointed with greenish tip. Filaments variable in length. Style longer than the stamens; stigma 3-lobed. The Botanical Register mentions var. *aurea*, var. *cuprea*, var. *obscura* and var. *brevilimba*.

NOTES.—This species with its golden or copper colored flowers was sent to Mr. Mackey by his collector Mr. Anderson with some other species derived from Montevideo, Uruguay, in spring 1929.

Along with the description of plate 3596 of Curtis's Bot. Mag. we find the statements: "Of this pretty *Habranthus*, four varieties are noticed by Mr. Herbert in the Bot. Reg., all apparently, from Montevideo. The plant must have an extended range. I possess specimens from Buenos Ayres gathered by Tweedie, from Araucania, S. Chile, by Mr. Reynolds; and Mr. Drummond sent the species from Texas (third collection, n.410 of dried specimens) which Mr. Herbert has pronounced to be the same differing slightly in the shape of the segments of the floral covering."

3. HABRANTHUS BRACHYANDRUS (Baker) Sealy, Journ. Roy. Hort Soc. 62: 208. 1937.—*Hippeastrum brachyandrum* Baker Pi. 7344 Curtis's Bot. Magaz. 1894. Handb. Amaryllidaceae 42, 1888. Gard Chron. 2:154, 1890.

DESCRIPTION.—Bulb ovoid, tunicate, 2.5 cm. in diameter. Leaves 3 to 4 linear, pale green, glabrous, appearing before the flowers. Scape 30 cm. long, terminated into one flower. Pedicels erect, 5 cm. long. Spathe equally as long as the pedicels, one or two valved, tubular toward the base. Perianth funnel-shaped, about 7 cm. long; throat deep claret-red; segments pale pink, oblong-lanceolate, 2.5 cm. wide toward the middle; the upper half spreading when full flowering. Tube cylindric, short. Stamens reaching half the length of the lobes of the perianth. Anthers linear, versatile, large. Stamens and style of the same length. Stigma 3-lobed.

NOTES.—Baker states that the original herbarium plant which was described in 1888 was collected by Perodi along the banks of the River Parana, at the place where it leaves Paraguay to enter the territory of Argentina. Soon afterward bulbs were introduced from Buenos Aires by Mr. A. C. Bartholomew of Reading.

4. HABRANTHUS VERSICOLOR Herb. pl. 2485 Curtis's Bot. Mag. 1824.—Herbert. Amaryllidaceae 166, 1837.—Kunth Enum. plant. 5: 498, *Hippeastrum versicolor* Baker, Journ. Bot. 7: 82, 1878.

DESCRIPTION.—Bulb oblong, dark to almost black. Leaves 30 cm. long, 6 mm. wide, acute, three or more to each plant. Scape 10 to 12 cm. long before the appearance of the leaves, being reddish at first, becoming later on pale and greenish. Spathe red, 2 to 3 cm. long; peduncles 2.5 to 3 cm. long, pale green. Perianth 4 to 5 cm. long, red at first, later becoming white tinged with pink, especially toward the tip of the segments. Stamens 2 to 2.5 cm. long. Style 3 cm. in length; lobes of the stigma 6 mm. long, fimbriated.

NOTES.—This species is supposed to be native to Uruguay and Brazil, Herbert states that the bulb of the plant he described in Botanical Magazine was imported from Maldonado in South America. It flowered at Spofforth during January. He states that there is a four-fold diversity of the petals and in this diversity of the petals, he says, *Habranthus* agrees with *Hippeastrum* (= *Amaryllis*), however, the diversity of its filaments follow a different rule.

5. *HABRANTHUS ROBUSTUS* Herb. ex Sweet. Hort. Britt. ed. 2. 506, 1830. (Nomen).—Roemer. Syn. Monogr. 4: 100, 1847.—Lodd. Bot. Cab. t. 1761, 1831.—Kunth. Enum. Plant. 5: 498, 1850. pro parte.—Stapf. T. 9126 Curtis's Bot. Mag. 1926.—*Amaryllis robusta* Spach Hist. Veg. 12: 416, 1846.—*Hippeastrum tubispathum* Baker in Jour. Bot. 16: 416, 1878.—*Zephyranthes robusta* Baker in Handb. Amaryllidac. 35, 1888.—Pax. Engler Bot. Jarb. 9: 320, 1890.—Hicken. Chloris Platens. Argent. 70, 1910.—Hauman. An. Nac. Hist. Nat. Buenos Aires. 29: 277, 1917.—*Z. brachyandrum* W. Watson in Gard. Chron. 18: 132, 1895.

DESCRIPTION.—Bulbs globose, about 3 cm. thick; tunics dark-brown to almost black; collar to 4 cm. long, stoloniferous. Leaves succeeding the flowers, linear, obtuse, slightly channelled, 10 to 30 cm. long, 5 to 10 mm. wide, green, somewhat glaucous. Scape one-flowered, 10 to 15 cm. long, rather stout. Spathe tubular, about 4 cm. long, bifid along the upper third which is inserted 6 to 8 cm. from the top of the stalk. Perianth funnel-shaped, limb 6 cm. long, 8 to 10 cm. wide, light pink with white. Tip of the segments carmine, oblanceolate. Perianth outside toward the base greenish colored. Tube 2 to 4 mm. long, 5 mm. wide. Filaments declinate, two longest 4 cm., two shortest about 2 cm. long, the remaining intermediate. Anthers half-moon shaped, 4 to 5 cm. long. Style 5 cm. long, lobes of the stigma 3 mm. in length, recurved. Capsule 2 cm. thick, 3-lobed. Seeds 8 mm. long, 5 mm. thick, thin unevenly winged.

NOTES.—Native to Uruguay and adjacent parts of Argentina.

6. *HABRANTHUS SYLVATICUS* (Mart. ex. Schultes) Herb. Amaryllidaceae 166, 1837.—*Hippeastrum sylvaticum* Baker Journ. Bot. 7:81, 1878.

DESCRIPTION.—Bulb globose, small. Leaves linear, narrow, longer than the scape, 30 cm. long, 2 to 3 mm. in width. Scape 10 to 12 cm. long, green. Spathe 3 cm. long, bifid for one third. Peduncles 2 to 2.5 cm. long. Perianth included, 5 to 6 cm. long; tube 2.5 to 3 cm. long, green with a thin faucial membrane. Limb funnel-shaped, purplish above, green below.

NOTES.—Has been reported by Herbert from Castingas, Bahia, Brazil, where it grows probably in the cooler regions of the mountains.

7. *HABRANTHUS GRACILIFOLIUS* Herb. T. 2464 Curtis's Bot. Mag. 1824.—Amaryllidaceae 165, 1837.—Kunth. Enum. Plant. 5: 497, 1850.—*Hippeastrum gracilifolium* Baker. Journ. Bot. 7:82, 1878.

DESCRIPTION.—Bulb oblong. Leaves linear, slender, nearly cylindric, 30 to 45 cm. long; upper surface with a deep groove. Scape 16 to 20 cm. long, 1-flowered. Spathe green, bifid, tubular at the base. Perianth 2.5 to 3.5 cm. long; tube green; limb pale purple, expanding in the sunshine, closing at night. Stigma trifid. *H. gracilifolium* var. *Boothianus* Herb. Amaryllidaceae 165, 1837. T. 1967 Edwards Bot. Reg. 1837, is according to Herbert, a variety, while Booth considers this form as a distinct species. This variety flowered at Sir C. Lemon's garden about 1836 and is distinguishable from *H. gracilifolius* by "a rather longer peduncle, red on the germen peduncle and spathe, and the marked diversity of the filaments, but they are not exactly of two lengths in the specimen." (Herbert).

NOTES.—Native to Uruguay. Herbert reports that this little plant species was also imported from Maldonado in South America.

8. *HABRANTHUS CARDINALIS* (C. H. Wright) Sealy. Journ. Roy. Hort. Soc. 62: 208, 1937.—*Zephyranthes cardinalis* C. E. Wright. T. 8553 Curtis's Bot Mag. 1914; *Zephyranthes bifolia* (Aublet) Roemer, *Herbertia* 6(1939); 121-123, plate 149. 1940.

DESCRIPTION.—Leaves ligulate, acuminate, 12 to 14 cm. long, 6 to 8 mm. wide, somewhat keeled beneath and channelled above. Scape 10 to 11 cm. long, rose pink toward the base, the rest being green. Spathe rose pink, apex acute, its base being slightly flattened 12 to 16 mm. long. Perianth red, bent toward one side, bright red, funnel-shaped; tube 2.5 cm. long, greenish toward the base; segments somewhat spreading, oblong-ob lanceolate, thickened near the tip. Filaments reaching near or above the perianth-segments. Anthers oblong, violet. Ovary short, elliptic; stigma trifid.

NOTES.—Native to Santo Domingo.

Hume (*Herbertia* Vol. 6. 1939) places this species in *Zephyranthes* and he may be right in doing so. It is retained here tentatively. This is a border-line case that needs further attention.

9. *HABRANTHUS PEDUNCULATUS* Herb, Amaryllidaceae 161, 1837. *Habranthus bifidum* Herb. in Bot. Mag. t.2597. *Hippeastrum bifidum* Baker. Journ. Bot. 83, 1878, Handbook of the Amaryllidaceae 43, 1888.

DESCRIPTION.—Bulb globose, 1.5 cm. in diameter; scale dark brown; neck 5 to 7 cm. long. Leaves 2 to 3 linear, somewhat glaucous, 30 cm. long. They appear after flowering. Scape slightly compressed, 30 cm. long and 3 to 6-flowered. Spathe-valves 5 to 7 cm. long, lanceolate; pedicles 2 to 5 cm. in length, slender. Perianth bright red, erect or suberect, 4 to 5 cm. long; tube short, cornulate at the throat; segments oblanceolate-unguiculate, obtuse, 6 to 8 mm. in width. Stamens declinate, unequal, reaching about half the length of the limb. Anthers 3 mm. long. Style longer than the stamens. Stigma 3-lobed.

NOTES.—Native to the plains of Buenos Aires and Montevideo. This species was introduced in 1825 by Lord Carnarvon. It flowered during March. Baker states about this S. American species: "I cannot separate as species *Habranthus kermeduenus* Herb. (Bot. Mag. t.1638), *H.intermedius* Herb. (Bot. Mag. t.1148), *H.nobilis*, *nemoralis*, *spathaceus*, *angustus* (Bot. Mag. t.2639), *pulcher* and *pedunculatus* Herb."

10. HABRANTHUS MENDOCENSIS (*Baker*) *Sealy*. Jour. Roy. Hort. Soc. 62: 208. 1937. *Habranthus mendocinus* *Philippi*. Anal. Univ. Chile. 2:406, 1892. *Eustephia Macleanica* Baker. Ref. Bot. t.332 non Herb.

DESCRIPTION.—Bulb ovoid, 3 cm. in diam.; neck short; scales dark brown. Leaves linear, 30 cm. long, glaucous. Scape 15 to 30 cm. long, 2 to 6-flowered. Spathe valves lanceolate, 3 to 5 cm. long; pedicels 2.5 to 7 cm. in length. Perianth funnel-shaped, horizontal or ascending, 3 to 5 cm. long; yellow or red; tube short, greenish, crenulate at the throat; lobes oblong-lanceolate, pointed, 6 mm. wide. Stamens shorter than the perianth, declinate; anthers 3 mm. long. Style longer than the stamens; stigma 3-lobed. The var. *pallidus* Herb. Lodd. Bot. Cab. t.1760 possesses pale yellow flowers.

NOTES.—This species is native to the environs of Valparaiso, Chile. It was first illustrated by Louis Feuillée.

11. HABRANTHUS JUNCIFOLIUS Traub & Hayward, *Herbertia* 12 (1945): 40-41. 1947.

(The reader is referred to the original description in *Herbertia*.)

LINNAEUS CONFIRMS DR. HILL'S IDENTIFICATION OF AMARYLLIS BELLADONNA LINN.

J. C. TH. UPHOF

In 1940 (Critical Review of Sealy's "*Amaryllis* and *Hippeastrum*," *Herbertia* 6(1939): 163-166. 1940), I referred to Dr. Hill's, "Outlines of a System of Vegetable Generation, London. 1758," a work that was kindly lent to me by Dr. Hamilton P. Traub from his personal library. In this book Dr. Hill described experiments that were based on a plant that he definitely identified as *Amaryllis belladonna* Linn., by citing Linnaeus' phrase-name for that species, and page reference (p. 293.) to *Species Plantarum*, 1753. When I stated the case in 1940, I had overlooked a significant piece of evidence furnished by Carolus Linnaeus himself. In the second edition of *Species Plantarum*, 1763, an Appendix, pp. 1661-1682, consists of Addenda. It is important to note an item on page 1680:

Amaryllis Belladonna

Monographia System of Vegetable Generation. Lond.
1758. oct. t. 1-5.

Here Linnaeus definitely cites Dr. Hill's book, thus confirming the latter's identification of *Amaryllis belladonna* Linn., as the American

Belladonna. It is again obvious that this species cannot be at the same time also the South African, or Cape Belladonna which is now recognized as *Brunsvigia rosea* (Lamarck) Hannibal (syn.—*Callicore rosea* (Lamarck) Link).

One of Dr. Hill's illustrations (t. 1.), cited by Linnaeus, pictures a whole 2-flowered specimen of the American Belladonna. Linnaeus undoubtedly inspected this illustration and again there can be no question that he accepted this as representing the typical *Amaryllis belladonna* Linn. This also means that the phrase "*spatha multiflora*," as used in this connection, implicitly carries the meaning of "more than 1-flowered"; and the phrase "*corollis campanulatis aequalibus*" is used implicitly in the broad sense to include "lilium-like" flowers.

I am sorry that this reference was overlooked when the earlier articles were prepared, and it is published now so as to amplify the earlier presentations.

TERMINOLOGY FOR THE FLORAL ENVELOPE OF AMARYLLIDACEAE

HAMILTON P. TRAUB

In connection with the preparation of manuscripts on the *Amaryllidaceae*, it soon became apparent that the terminology in use, particularly in the case of the floral envelope, was inadequate. The types of the floral envelope in the *Amaryllidaceae* had not been definitely defined and were referred to either as a "perianth" or a "perigone," and the component parts were referred to as "perianth-segments," or "segments"; and "outer perianth-segments" and "inner perianth-segments." The same terms were used in totally different connections—where the parts of the envelope were free, or were united for part of their length below into a tube. It was therefore necessary to adopt an exact terminology.

It was evident that in the case of a large treatment of the *Amaryllidaceae* the constant repetition of such three-word-phrases to convey simple ideas would add materially to the cost, not to mention the ambiguous usage of the phrases. After some trials, therefore, the shortest possible terms were selected or coined, if none were available, to cover the needs. The terms and their meanings are classified in the key that follows:

KEY TO TERMINOLOGY OF THE FLORAL ENVELOPE IN AMARYLLIDACEAE

[The essential parts of the flower in general are the reproductive organs; (a) the ovule bearing organs (gynoecium), and (b) the pollen bearing organs (androecium), which may both be present in the same flower, or singly in separate flowers on the same or different plants; but (c) a floral envelope that covers the reproductive organs before the flower opens, may also be present or absent. In the *Amaryllidaceae*, the floral envelope is always present, and may be modified, as shown in the key below.]

1a. Flowers with floral envelopes :

- [2a. Floral envelope consisting of distinct outer and inner partsI. PERIANTH

3a. Outer, usually green, envelope1. calyx

3b. Inner, usually colored other than green, envelope2. corolla

(This subject is not considered here since it has no application to the *Amaryllidaceae*.)]

- 2b. Floral envelope of similar parts (by evolution from type 2a), usually colored other than green (This is the kind of floral envelope encountered in the *Amaryllidaceae*)

II. PERIGONE

(The perigone in the *Amaryllidaceae* may be without or with appendages that may consist of fimbriae, scales, crown (corona), or cup, arising at the throat of the tepaltube. Such a modification of the perigone is termed a “*paraperigone*.” Similarly, the modifications of the gynoecium and androecium are referred to as “*paragynoecium*” and “*parandroecium*,” respectively.)

- 4a. Parts or leaves of the perigone free (not united at base, as in *Leucojum aestivum*)TYPE A perigone
- The free portions of perigone, irrespective of origin
- A-1. tepals
- 5a. Outer, or sepaline tepalsA-2. setepals
- 5b. Inner, or petaline tepalsA-3. petepals

- 4b. Parts or leaves of perigone united for part of their length below into a tube (as in *Sprekelia*) very short tube; and *Amaryllis solandriflora*, very long tube)

TYPE B perigone

- 6a. Tubular portion of perigoneB-1. tepaltube
- 6b. Free upper portions of perigone above tepaltube, irrespective of originB-2. telapsegs
- 6c. Free upper portions of perigone above tepaltube on basis of origin :
- or sepaline
- 7a. outer/tepalsegsB-3. setepalsegs
- or petaline
- 7b. inner/tepalsegsB-4. petepalsegs

[1b. Flowers without floral envelopes :

(This subject is not considered here since it has no application to the *Amaryllidaceae*.)]

With reference to the use of the suffix “*seg*” (=segment), it should be noted that there are only a few obsolete usages of the word and no ambiguity can arise from that source. The word “*segment*” as applied to a portion of a tepal is the most apt one to use in this connection, but any combinations in which the whole word is used are too long, i.e., “*perigone-segment*” (14 letters), “*sepaline perigone-segment*” (23 letters), “*petaline perigone-segment*” (23 letters). By using the abbreviations “*se*” (=sepaline), “*pe*” (=petaline) as prefixes, and the suffix “*seg*” (=segment), these can be materially shortened,—“*tepalseg*” (8 letters), “*setepalseg*” (10 letters), and “*petelapseg*” (10 letters), respectively. At first these words may seem a little odd, but after a little acquaintance they do not seem out of place. The advantage is that they describe definite concepts concisely. It should also be indicated that the choice of substitutes based on the Greek words, “*petalon*” (=petal or leaf) and “*tmema*” (=segment) would indeed appear odd, and would not provide shorter words.

DEFINITION OF TERMS

[The terms preceded by an asterisk (*) are new.]

Perianth, the two floral envelopes, or calyx and corolla, when distinct and considered as a whole. Example: *Ranunculus bulbosus*.

Perigone, the two floral envelopes, or calyx and corolla, considered as a whole, when these have been so modified by evolution as to appear similar, but not necessarily exactly alike. Example: *Leucojum aestivum* (without tepaltube); *Amaryllis belladonna* Linn. (with tepaltube).

Tepal, a division of the perigone, sepaline or petaline in origin, when there is no tepaltube present.

**Setepal*, a tepal of sepaline origin.

**Petepal*, a tepal of petaline origin.

**Tepaltube*, a tube or cup made by the fusion of the lower portions of the tepals of the perigone.

**Tepalseg*, the free portion of a tepal when a tepaltube is present in the perigone.

**Setepalseg*, the free upper portion of a tepal of sepaline origin when a tepaltube is present in the perigone.

**Petepalseg*, the free upper portion of a tepal of petaline origin when a tepaltube is present in the perigone.

**Paraperigone*, a modification of the perigone other than that accounted for by the tepaltube and zygomorphy, such as appendages consisting of fimbriae, scales, crown (corona) or cup, arising at the throat of the tepaltube.

**Paragynoecium*, a modification of the gynoecium with particular reference to the ovary and style.

**Parandroecium*, a modification of the stamens (androecium), particularly the filaments, such as teeth or a membrane between the filaments, forming in the latter case a staminal cup.

ZEPHYRANTHES LONGIFOLIA

HAMILTON P. TRAUB

Recently, Mr. O. F. Garrett, Horticulturist, Pecos, Texas, collected for Miss Willie May Kell bulbs of an amaryllid in the Davis Mountains, about 150 miles west of Odessa, Texas. Some of these bulbs were presented for the Society's trial collection, and proved to be *Zephyranthes longifolia* Hemsley.

According to Miss Kell, "Mr. Garrett at Odessa, Texas, collected these in the Davis Mountains about 150 miles west of Odessa. Mr. Hannibal immediately sent an air mail inquiry regarding them to Major Pam. . . . I wrote to Mr. Parks, the author of an article in 1937 *Herbertia*, and he was kind enough to answer me regarding these bulbs: 'The *Zephyranthes* from West Texas is probably *Z. longifolia*. I collected this species at Odessa and south and west to the Rio Grande and El Paso. It flowers after every little rain in low flat places. About the only difference one can see is that the leaves which come after the flowers have disappeared are 13—15 cm. long.' But mine do not quite answer to this description: the leaves are present in advance and along with the flower, they are 21—28 cm. long, by 3 mm. wide, and deeply grooved; the scape is 13.3 cm. tall; the flower is 2.9 cm. long, Dresden Yellow (RHS 64/2) inside, and (RHS 64/3) outside, and does not open wide, and only lasts one day."

Zephyranthes longifolia Hemsley is a relatively little known species for it requires an alkaline soil for good results, and soon declines when grown in the usual acid soil mixture. It can be maintained if liberal amounts of ground oyster shell are added to the soil mixture. This species has a very wide range including Texas, New Mexico, Arizona and Mexico, and it would not be extraordinary if it proved to be a polymorphic species with coexistent ecotypes or other contrasted forms, or even polytypic, with subspecies showing geographical replacement. But in spite of its wide range, however, the species is apparently quite uniform.

Zephyranthes longifolia was proposed by Hemsley (Diagn. Pl. Nov. 3:55.1880) on the basis of material in the Kew Herbarium from New Mexico and Mexico. Sereno Watson (Proc. Amer. Acad. Arts & Sci. 18: 161. 1883), under the synonym, *Z. aurea* S. Wats., gave the following description on the basis of material from Texas, New Mexico, Arizona and Mexico:

"Distinguished from *Z. texana* by the shorter and stouter peduncle (rarely over 2.5 cm. long), the yellow perianth of the same color outside or usually greenish, the capsule much larger (1.2 cm. long), and the larger seeds (6 mm. long)."

Baker (Amaryll. 33. 1888), recognized the species, and gave the following description:

"Bulb obovoid, 2—2.5 cm. diam.; neck 3.8—5 cm. long; leaves very narrow, contemporary with the flowers in summer, 15—23 cm. long; peduncle slender, 7.6—15 cm. long; spathe 2—2.5 cm. long, tubular in

the lower half; pedicel much shorter than the spathe; perianth 2—2.5 cm. long, bright yellow, coppery outside; tube short; segments unguiculate, 6 mm. broad; stamens much shorter than the limb; style trifid; capsule-valves orbicular, 6 mm. broad."

The following description is based on part of the living plants collected as bulbs by Mr. Garrett, and grown by Miss Kell in Northwest Texas and by the present writer in the greenhouse in Maryland:

"Leaves 3—7, usually 3 or 4, appearing with the flowers, 2.1—2.8 dm. (to 4.6 dm.) long, and 2—3 mm. wide, grooved on top; peduncle almost terete, up to 13.3 cm. at time of anthesis, but later elongating to 16 cm. tall, 3 mm. in diam at base, 2.5 mm. at top, reddish at base, green above; spathe 2 cm. long, fenestrated, united for $\frac{2}{5}$ its length below; pedicel finally 1.5 cm. long, 2 mm. in diam.; flower 2.9 cm. long, Dresden Yellow inside and outside, never opening widely, and lasting for only one day; tepaltube short; tepalsegs not unguiculate; capsule 1 cm. high, 2 cm. wide; locules of capsule orbicular, about 1 cm. in diam.; seeds numerous, 14 in each locule, black, D-shaped, 8 mm. long, 6 mm wide."

In spite of its wide range, *Zephyranthes longifolia* apparently does not show very great variation as indicated by the above descriptions. Only one *reported* variation is notable. Baker (1888) reports "segments unguiculate" (=tepalsegs claw-like at base). Baker apparently based his description on dried specimens and this may explain the difference. In the dried material the bases of the tepalsegs may have been shrunk to give the impression of being "claw-like." Only a further checking of material from a wider range can settle this point.

Although this is not a spectacular species, it might be used as the basis of a race of hybrid *Zephyranthes* that could be cultivated over the wide range of Texas, New Mexico, Arizona and Mexico. Many, however, will be satisfied to grow it as it has evolved in nature.

AMARYLLIS MORELIANA (LEMAIRE) TRAUB, COMB. NOV.

In 1841 Morel flowered in France a species of *Amaryllis* that had been collected by L. Linden in Brazil, with no definite local area indicated apparently. Lemaire (1845) described this species from a specimen furnished by Morel in whose honor he named it. This species was not accounted for by Baker (1878, 1888), and was omitted through an oversight from the revisions of the genus *Amaryllis* Linn., by Traub & Uphof (1938, 1940). A translation from the French is given under "Description" below.

Amaryllis Moreliana* (Lemaire) Traub, *comb. nov.

Syn.—*Hippeastrum* (*Amaryllis*) *Morelianum* Lemaire, in L'Hort. Universel, 4: 37-38, plate facing page 37, (labeled *Amaryllis* (*Hippeastrum*) *Morelliana*). 1845.

DESCRIPTION.—Bulb oblong, fairly large, green; leaves 6, elongated-elliptical, contracted, canaliculated and somewhat sheathing at the base, membranous at the margins, rather strongly striated, light green underneath, paler underneath where the mid-rib is strongly swollen and prominent, 4.5 dm. long, 4.5 cm. wide; peduncle subcylindrical, hollow, 5 dm. tall, umbel 2-flowered; spathe-valves 2, split to the base, light green, persistent, much longer than the pedicels which are rather short; ovary short, subtrigonous; flowers very large, star-shaped; tepaltube short, closed in at the throat by a paragerigone of an annular obconic greenish-white corona, which is formed by swollen scales; tepalsegs subequal, elliptic-oval, acuminate; setepalsegs with green points; all tepalsegs of a bright red ocher red, minutely veined with purple, from the center of the base of each tepalseg, up to half of the length, appears a pointed area of green, the six pointed areas forming a green star; style longer than the filaments, both colored violaceous-rose; anthers relatively large, versatile, colored a gay violet; stigma subtrifid.

RANGE.—Brazil (No local area indicated.)

NOTES.—The corona-like paragerigone closing in the throat places this species in the subgenus *Omphalissa* (Salisb.) Baker.

Although the descriptive article is entitled, “*Hippeastre de Morel, Hippeastrum (Amaryllis) Morelianum*,” Lemaire, in the text, refers to the present species as a species of *Amaryllis* of the subgenus *Hippeastrum*. It is apparent that Herbert’s nomenclature was not wholly acceptable to him. The plate, drawn by Aug. Dunénil, and colored by Maubert, is labeled *Amaryllis (Hippeastrum) Morelliana*. In the Index Kewensis, the name indicated in the title of the article, *Hippeastrum (Amaryllis) Morelianum*, is taken as the one accepted by Lemaire. This interpretation is accepted by the present writer. The name on the plate apparently was due to an error, for Lemaire could not accept both names at the same time. The new combination proposed by the present writer is therefore in order.

This is a very striking species and would be well worth cultivating. It is hoped that the Fosters will be able to re-introduce it when they make their next trip to Brazil.

—*Hamilton P. Traub*

GREETINGS TO DAYLILY ENTHUSIASTS

ELMER A. CLAAR, *Chairman*
Daylily Committee

After a succession of gorgeous spring flowers, followed by the incomparable flowering shrubs, daffodils, trilliums, tulips, the breath taking late May and early June irises, peonies, lilies and delphinium, do you feel morose? Is life an empty void with that gone, gone feeling? Do you philosophize as to the lack of permanence of the things that are so dear to all our hearts? Do you feel like the Chinese philosopher whose dragon is eternally chasing the flaming pearl as a symbol of man's striving after the unattainable?

No reason for this melancholy. A gardener's life need not be an empty void from late June, July and August until the fall favorites, the dahlias and the chrysanthemums, arrive.

Look up a daylily enthusiast. Visit his garden. Be careful! He has daylilyitis and it's contagious and infectious—and he believes he's having fun, all at the same time! Not only that, but he will wish it on you.

Note the diversity in the color range in daylilies—cream, yellow, orange, pink, red, purple, to almost black. Note the interesting combinations of these colors, the various forms and patterns, the giants and the dwarfs, the infinite variety.

If flower sentiment in other folks is just plain piffle to you, what you want is a flower with a future, with a growing public demand. Examine the facts. You will find the daylily is mounting in public favor faster than any other garden perennial. Acquire a few plants; watch them grow; show them to your friends and customers. Watch out! Penicillin and D. D. T. are no protection; nothing can help you. You've got daylilyitis!

I now assume you are mildly enterested or you never would have read this far.

Have you observed that there is hardly an iris specialist or peony specialist who issues a catalog at the present time who does not also list daylilies? Many of the specialists in irises, peonies, and chrysanthemums also are devoting an increasing amount of time to hybridizing daylilies. This is natural inasmuch as no matter how much enthusiasm you have for the May and early June flowering perennials, they do not fill the void in your garden that daylilies fill in the latter part of June, July, and August.

Daylily enthusiasm has increased so much that a group of individuals in the Central States has organized the Midwest Hemerocallis Society. They already have had a daylily show, they have facilities to broadcast information about the daylily, and do so, and I understand their membership is growing by leaps and bounds. The best of luck to them. There is no question but that we can expect great things from this group. In addition, another group, led by Mr. Everett Lilly of Decatur, Illinois, has been expending a tremendous amount of work

with the object of organizing a national society devoted exclusively to daylilies. The more people that bear the torch, the sooner the merits of the daylily will be recognized. The best of luck to Mr. Lilly, his associates and supporters. I should like to see a daylily society in every state, county, and town in the United States.

The American Plant Life Society, the pioneer Society that has been popularizing daylilies, has at present trial garden collections of daylilies at:

The College of Agriculture, University of Florida, Gainesville, Fla., in charge of Prof. John V. Watkins.

The Department of Parks & Public Property, City of Des Moines, Iowa, in charge of Dr. Paul L. Sandahl.

The Department of Horticulture, Southwestern Louisiana Institute, Lafayette, La., in charge of Prof. Ira S. Nelson.

The Department of Agriculture, Cornell University, Ithaca, New York, in charge of Dr. Raymond C. Allen.

The Division of Horticulture, Texas Agricultural Experiment Station, College Station, Texas, in charge of Dr. S. H. Yarnell.

The Milwaukee City and County Parks, 714 Majestic Bldg., Milwaukee, Wisc., in charge of Mr. Chas. E. Hammersley.

In addition, the Men's Garden Clubs of America have taken active steps to familiarize the public with the virtues of daylilies and have asked me to serve as CHIEF HEMEROCALLIARIAN for this organization. At present there are fifty-three garden clubs belonging to the Men's Garden Clubs of America and the president of each of these clubs is appointing a local chief hemerocalliarian, who is to acquire a collection of daylilies and emphasize the importance of this flower. Some of the letters from these local hemerocalliarrians have been very enthusiastic and many of them have collections of considerable size.

The American Plant Life Society, the pioneer daylily organization, is making genuine progress in the compilation of a check-list through the enthusiasm of Dr. Norton, assisted by Mr. M. F. Stuntz.

In 1940, I attempted to classify the daylily hybrids according to the time of bloom and fundamental color. I also conducted a poll to determine the ten best daylilies in commerce over a period of three years, using a numerical rating system, with "A" as 95, "B" as 85, "C" as 75, and "D" discarded. I also attempted to conduct a poll to determine the first, second, and third best flowers in each blooming season and each color class for plants in commerce, over a period of three years. I sent these polls to all the individuals that I thought were interested in daylilies and who might be able to see a considerable number of plants. The results of these polls were published in *HERBERTIA*. It was a tremendous amount of work. I followed these experimental daylily polls in 1941 and 1942 along the same general lines.

Part of this was the system used by Mr. Kelso. After three years, I decided that the results of this plan merely pointed out the daylilies that were widely distributed. As a result, I next made a selection of the

daylilies that I liked the best in each blooming season and in each color class. I sent this list to the growers and hybridizers that I knew or that I had heard were growing a large number of plants or those who could see the latest introductions. The result was that very few of the most prominent daylily hybridizers replied to my inquiry. Part of this was due, I believe, to the fact that it takes a lot of time to compile a list like this, and also a hybridizer is reluctant to admit that his plant is not so good as someone else's introduction, after he has acquired a considerable stock of any one introduction. Therefore, not much was accomplished to change my mind about the plants that I had selected as best.

The list that I used in the 1944 *Herbertia* (pages 340-344) was cut down in an article in the April, 1945 issue of *Better Homes and Gardens*, in which I set out a list of daylilies in each blooming season and color class that I like best. In this article I attempted to divide these flowers into four groups, arranged largely according to the cost of the plants.

The first group was a recommendation to the individual who had never grown daylilies and who wanted a few for a small sum of money. Here is the list:

Early Bloomers—(before June 1 in Chicago suburbs)

Flava—lemon-yellow

Gold Dust—yellow, bronze back

Dr. Regel—orange

Intermediate—(between June 10 and 20)

Winsome—creamy yellow

Summer Bloomers—(approximately June 20 to August 1)

Hyperion or *Patricia*—light yellow

Golden Bell—yellow

Ophir—orange-yellow

Golden Dream—orange

Mikado—eyed variety

Cissy Guiseppe—red

Fulva—polychrome

Late Bloomers—(approximately August 1 on)

Multiflora Hybrids—various

The second group was based on the assumption that the individual was acquainted with daylilies, having acquired some of the old time, inexpensive types, and wished to add another dozen or so plants and keep the cost down to \$12 or \$15. The group includes:

Early—

Flavina or *Estmere*—yellow

Intermediate—

Queen of May—orange-yellow, large

Summer—

Moonbeam—cream-yellow, tall

Hesperus—tall, large medium-yellow, floriferous

Golden Bell—yellow

Mrs. A. H. Austin—orange

Golden West—large, showy

Linda, George Yeld, and Chengtu—Polychromes, beautifully patterned

Imperator—red-orange

Chisca—a bicolor and fascinating

Late—

Dorothy McDade—yellow, one of the finest of all.

The third group perhaps could have been omitted but it was a selection of the older introductions and plants with a relatively wide distribution in the newer colors of red, raspberry, pink, and purple. This group includes:

Pastel pink—*Pink Charm*

Raspberry—*Piquante*

Rose—*Fulva Rosalind*

Red—*Emperor Jones*

Maroon—*Wolof*

Ruby-red—*Royal Ruby*

Purple—*Theron*

In the fourth group I selected my favorites among the Named day-lilies in each color class, irrespective of price. In the Better Homes and Gardens article, I restricted my choice to one or at most two plants so as to simplify the matter. This list was as follows:

Early—

Yellow—*Earlianna* or *Elizabeth*

Orange—*Judge Orr*

Intermediates—

Creamy-yellow—*Winsome*

Light yellow—*Little Cherub* (this is my seedling, so I'm prejudiced)

Orange—*Queen of Gonzales*

Red—*Wekiwa*

Bicolor—

Pastel—*Symphony*

Strongly contrasting—*Zouave*

Polychrome—*Dominion*

Eyed variety—*Gay Coquette* (again my seedling)

Summer—

Cream—*Vespers*

Light yellow—either *Hesperus, Mission Bells* or *Mrs. B. F. Bonner*

Yellow—*Anna Betcher*

Orange—*Majestic*
 Orange-yellow—*Golden West*
 Pink—*Sweetbriar*
 Raspberry—*Piquante*
 Purple—*Potentate*
 Rose—*Dawn Play*
 Red—*General MacArthur, Red Sox, or Tejas*
 Ruby Red—*Royal Ruby*
 Maroon—*Morocco Red or Wolof*
 Bicolor—
 Pastel—*Debutante*
 Contrasting—*Bold Courtier*
 Polychrome—*Painted Lady, Twinkle Eye* (mine), *Honey Red Head*,
 and *Dr. Stout* (all different and very good in my garden)
 Eyed variety—*Mikado*

Late—

August Prince

In checking over this list, there are only two substitutions I would like to make. In place of *Anna Betcher*, I would choose *Mongol* as a better flower, and in place of *Majestic*, I would select *Joanna Hutchins*.

As a result of these articles, I received numerous letters from individuals who wished to know where they could acquire these plants. I then got out a mimeographed sheet giving the names of the hybridizers who had made the crosses of the hybrids named. Most of the people wanted to know where they could buy these plants so in a second set of sheets I set out all of the commercial gardens (that I had listed at that time) where one might buy these daylilies.

I now believe I have a better approach to the matter, suggested by Mr. Ralph Wheeler. This year I shall ask each hybridizer to list the plants, if any, that he has originated, in each blooming season and color class, which he believes are better than or comparable to my choice of plants. I shall try this out in 1947.

The effort on my part to make such a selection perhaps is presumptuous and no doubt many would select other plants than those which I have chosen. Obviously, with the continued introduction of hundreds of plants a year, it is impossible for any one individual to see all the new introductions, and, in addition, if any two people did see them all, I know that there necessarily would be disagreement as to which was the best in a considerable number of plants. However, I have spent quite a bit of time at the various hybridizers' gardens in the southern, mid-western, and eastern parts of the United States, and have grown nearly five hundred named varieties of daylilies, so my selection is a starting point which does set a standard by which one can make comparisons. I only hope it will be helpful to those who are interested in acquiring daylilies. I also hope it will help to place a limitation on the number of new introductions. Unless a plant is better than one that has been selected in a given blooming season or color class, or in some other

important particular, there is no excuse for introducing it. In these groups, I obviously have not mentioned any unnamed seedlings and a considerable number of named flowers that I have not seen in bloom in established plants.

The daylily has proved to be one of the most stable of all perennials, in spite of the tremendous advances in some of the color classes. *Flava* has been in the United States for several hundred years and by any standard that you wish to use, the plant still is beautiful and worth growing. *Apricot* apparently was the first hybrid daylily of which there is a definite record. It was exhibited in London in 1892 as a seedling of George Yeld's. It still is worth growing. *Winsome* was mentioned in 1925 by George Yeld and is one of my favorites. I have seen nothing up to this time that would make me wish to discontinue growing any of these daylilies. This also is true of *Hyperion*, *Waubun*, *Ophir*, *J. S. Gaynor*, *Mikado* and many other daylilies that are old time favorites.

One of the pioneers among daylily hybridizers, Mr. Amos Perry, recently sent me a copy of a 209-page book which he calls his diary. It is a marvelous tribute to his scholarship, virility and enthusiasm as a plant specialist. It sets forth a Certificate of Appreciation by the Council of the Royal Horticultural Society to Mr. Amos Perry for his work as a HEMEROCALLIARIAN, dated July, 1943. This book also contains a reprint of a letter by the pioneer of all daylily hybridizers, that modest gentleman, Mr. George Yeld.

We all have much for which to be grateful to Mr. Perry. He sang the praises of daylilies when few had the inclination to listen.

In Volume 8 of HERBERTIA, which was a Daylily Edition, Mr. Perry says:

“*Hemerocallis fulva rosea*, a present from Dr. Stout, has worked wonders and transformed this genus—the second, third and fourth generations are wonderful—and I am of the opinion will be responsible for lifting this interesting genus from obscurity to one of the most popular of our summer-flowering border perennials.”

Pardon me, I have daylilyitis—I can't help it!

REGISTRATION OF NEW AMARYLLID CLONES

Descriptions of new clones of hybrid amaryllids for this section should reach the editor by September 1 if at all possible. Information sent after that date may be held over to the next issue if space is not available. This information is published to avoid duplication of names, and to provide a place for authentic recording of *brief* descriptions. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used.

At present there is a limit to the number of descriptions included from any one member. Not more than five brief descriptions of clones

under each generic heading will be published free of charge from any one member in any issue of HERBERTIA. Additional descriptions will be published in the advertising section at regular ad rates. The first five descriptions will appear in this section and the excess will be continued in the section entitled, "Buyers Guide."

HYBRID NARCISSUS CLONE

Introduced by J. S. Cooley, Berwyn, Maryland.

Canary Twins. An outstanding clone, 18 inches tall; umbel of two miniature trumpet type flowers, pedicels upright, ovary and flower only slightly inclined so that the twin flowers are in full view when one stands over them; flowers are for practical purposes a light Canary Yellow (RHS 2/1 to 2/2) self; tepal segments about 1 inch long, Canary Yellow (RHS 2/2,) trumpet slightly over 1 inch long, and about 1 inch across at the rim, Canary Yellow (RHS 2/1); moderately fragrant; flowers are of good substance and long lasting as cut flowers. Season; mid April to early May.

HYBRID AMARYLLIS CLONES

Introduced by Mr. Garnald D. Zeiner, Lost Spring, Kansas.

Crimson Comet; Reginae type A; 8 flowers; crimson with a yellow stripe down center of each tepalseg; flower 6½ inches in diameter.

Ruby; Leopoldii type A; 2 flowers; dark ruby; flower 6-5/8 inches in diameter.

Tippy; Reginae type B; 4 flowers; white with salmon stripes and tip on each tepalseg; flower 4-5/8 inches in diameter.

HYBRID DAYLILY (HEMEROCALLIS) CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.*; (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.*, (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.*; (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.*; (5) *Texas A. & M. College, Dept. of Horticulture, College Station, Texas*; and (6) *Des Moines Park Board, Des Moines, Iowa*. [Complete addresses are given under *Officers and Committees*, below.]

Introducers should send complete collections of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced by Ralph W. Wheeler, Winter Park, Florida.

Asia. As the name would imply this is a huge flower, opening flat with shallow throat, the segment tips being somewhat twisted. In color-

ing it is a glistening gold yellow with greenish tones. On the outside of the throat color, which extends well up the segments, there is a faint violet dusting. Sometimes the flowering stems produce proliferations. In Florida it does not bloom until late in June.

Aurora. This pale rose pink flower with slightly deeper coloring around the throat closely approaches a true pink self. The throat is yellow as also are narrow petal midribs, the cup of the throat being green. It is not a large flower nor is it a vigorously growing plant in Florida, however it is a recurrent bloomer here. The sepals are slightly recurved and the petals beautifully frilled. It has 30 inch stems.

Cerise. The strikingly beautiful coloring of this flower is produced by its rosy crimson pile on a ground of scarlet. In complete color harmony is the gold orange throat, the orange extending in lines through the sepal and petal centers. The fine form of the flower adds greatly to its beauty. It is compact with wide segments irregularly recurved and its petals are very frilled. Its stems are to three feet.

Cornell. A bicolor having petals of a fine, truly red color is something new in my experience. This flower is deep, rich crimson with light yellow sepals, throat and lines along the petal midribs. There is slight dusting on the sepals. The flower is medium large, wide segments tightly recurving from a compact throat, and has frilled petals. The stems are 32 to 36 inches. It makes divisions readily and is a recurrent bloomer in Florida.

Naranja. This is a clear, deep orange of clean color even deep in the throat. In happy contrast to my previous experience with large, deep orange daylilies, this flower opens perfectly and has great beauty of form. It has wide segments, the petals being $1\frac{7}{8}$ inches and the flower diameter 7 inches. The petals are frilled and are irregularly recurved while the sepals are regular. The stems are well branched and three feet tall. It blooms at mid season in Florida, four to six weeks later than *Aurantiaca Major*, and in only one year has it been a recurrent bloomer.

EDITORIAL NOTE.—The *Hemerocallis* clones, *Scarlet Sunset* and *William Penn*, introduced by Mr. Wheeler in 1946, will be described in 1947 HERBERTIA.

Introduced by Chas. E. F. Gersdroff, 1825 North Capitol St., Washington, D. C.

Day Dress. 38"; 7", 12 hours, heavy substance, petals broad, ruffled edges, sepals medium broad smooth, even toned reddish orange, but not scarlet, opens mid-June (*Golden Dream* x *Calypso*).

Elizabeth Lapham. 40", $5\frac{3}{4}$ ", 24 hours, heavy substance, edges of petals ruffled, sepals fluted, all tips reflexed, full, self of glistening picric yellow to greenish yellow throat, opens early July (*Golden Dream* x *Calypso*).

Garden Bouquet. 40", 44 buds, heavy stalk, 4¾", 27 hours, heavy substance, broad dark green wavy edged foliage, pale lemon yellow to oil yellow throat, opens medium late June, (*Lemona* x *Calypso*).

Lady Elizabeth. 36", 5½", 24 hours, heavy substance, (inform. intr. 1942); reflexed lily form, edges of petals crimped, self of lemon chrome, opens mid-June (*Lemona* x *Calypso*).

Lily Ruffles. 36", 5½" 18-23 hours, heavy substance, all segments heavily ruffled on edges, sepals orange to mars yellow (brownish orange), edged light cadmium, reverse deeper, edged amber brown, petals with raised mid-band, light cadmium with sheen of deep chrome, opens early July (*Fireglow* x *Vivid Sun*).

Introduced by Stanley E. Saxton, Faust, New York.

Zebra. A deep toned bicolor in tones of rust red and orange. The segments are regular and recurved, the petals being an ochre red tone with some rose infusion. The sepals are orange in sharp contrast. The plant is a very strong grower, increases rapidly and makes a colorful display even under adverse conditions. Scapes about 30" tall (*Cabellero* x *Goldeni*).

Introduced by E. J. Kraus, Univ. of Chicago, Chicago, Ill.

Flambeau. Height 36 inches. Leaves erect, recurved at tips, bright green, wide. Scape erect, 3 to 5 branched, 25 to 30 flowered, flowers borne just above foliage mass. Flower slightly pointed upward, tubular reflexed, six inches in diameter, segments overlapping, quick shedding. Petals 4.5 inches long, 1.25 inches wide, broadly oval, distal five-sixths bright grenadine red toned flame scarlet, veins very slightly darker, remainder orange. Sepals 4 inches long 1 inch wide, same color as petals. General effect in sun bright cherry red. Retains color and texture entire day. Odorless. Season July 1 to September 1, recurrent, free bloomer. Vigorous growth and propagation. Seedling of [(*Waubun* x *Rajah*) x (*Rajah* x *J. S. Gayner*)].

Vermilion Cliffs. Height 40 inches. Leaves erect, recurved at tips, wide, bright green. Scape stiff, erect, 2 to 4 branched, 20 to 25 flowered, flowers borne 6 to 8 inches above foliage mass. Flower faces directly outward or slightly upward, wide spreading, flat or slightly reflexed, shallow cupped, 7 inches in diameter; segments very broad and overlapping; quick shedding. Petals 4 to 5 inches long, 1.7 inches wide; very broadly ovate, distal half and lower margins clear bright vermilion, scarlet, toned grenadine red with clear orange throat. Sepals 4 inches long 1.5 inches wide, same colors as petals. General effect exceptionally brilliant vermilion scarlet, prominent orange throat. Stately and erect. Retains color and texture in bright sun. Odorless. Season first week in July to middle of August. Vigorous growth and propagation. Seedling (*Dauntless* x *fulva rosea*).

Pamela. Height 40 inches. Scape sturdy, erect, 3 to 5 branched, 20 to 30 flowered, rising 12 to 15 inches above foliage. Leaves wide,

glaucous green, upright, curving outward. Each flower 4 to 5 inches in diameter, short tube, wide-flaring flat cup facing directly outward. Petals 3.25 inches long, 1.25 inches wide, broadly oval, uniformly very pale buttercup yellow slightly darker at base. Sepals 3.25 inches long, 1 inch wide, slightly recurved, same color as petals, slightly darker at tips and basal margins. Slight, delicate odor. Thick waxy texture. Season July 5 to August 20. Seedling of *J. S. Gayner* x *Mrs. W. H. Wyman*.

Ute Chief. Height 40 inches. Scape erect, graceful, 3 to 4 branched 25 to 40 flowered. Leaves wide, dark green, upright, recurved at tip. Each flower long, tubular flaring, very slightly irregular, slightly pointed upward, quick shedding. Petals 4.25 inches long 1.25 inches wide long oval, distal three fourths nopal red indistinctly veined oxblood, with lighter midvein, deepening to oxblood toward top, scarcely discernible eye zone; throat deep orange. Sepal 4 inches long .75 inches wide tapering and slightly twisted towards tip, distal three fourths brazil red over cadmium, lighter at tip, inconspicuous oxblood eye zone. Remainder orange. Total effect rich brown red. Texture smooth, heavy. Odorless. Retains color in bright sun. Very free flowering. July 15 to September 1. Seedling of *Cressida* x *Rajah*.

Introduced by J. B. S. Norton, Hyattsville, Md.

Narcissa. Scape strong, 3 feet; flower funnel-form, full, 5 inch wide, chrome lemon with faint flush in throat, fragrant, day blooming; petals 1½ inches wide, sepals 1 inch. Blooming in July.

Bright Eye. Scape 2 feet; flower starlike, 3-4 inches wide, golden glow with narrow Eugenia red halo, slightly fragrant, day blooming, petals 1 inch wide, sepals ¾ inch. August blooming.

Phoenicia. Scape strong, 3 feet, flower open wide, the segments recurved, smooth, flower width 4-5 inches, day blooming; petals 1¼ inches wide, sepals ¾ inch; color cardinal. July and August blooming.

Decoration. Scape strong, 3 feet; flower full, wide spread, 4-5 inches wide; petals 1¼ inches wide, pepper red with wide light yellow center stripe; sepals over ½ inch wide, light yellow; day blooming in July and August.

Introduced by L. Ernest Plouf, Lawrence, Mass.

Mers-el-Kebir. 3 ft. July-Aug. Very full spatulate overlapping segments; small flower; fine waxy substance; good form; roundly and decidedly recurved; all segments crinkled on edges; soft peachy-orange slightly speckled; keeps well late. Outstanding as to substance, form and fullness.

Monotone. July. Large full 6 inch flower; smooth; tailored; well open; all segments even tone rich soft henna; deeper area; orange throat; good substance; round outline; outstanding in form, size and evenness of tone.

North Africa. July-Aug. The color of this variety is a reminder of the red North African soil; very full 6 inch flower; all segments

evenly toned deep henna; no midrib color; deep maroon zone on inner segments; orange throat; good substance, form and keeping quality; round outline; well recurved; medium throat expansion; outstanding for fullness and fineness in such a huge flower.

Oran. July. Bright heavily toned rich deep henna-red self; 5 inch well open flower; graceful and full; orange throat; no midrib color; heavy substance; chamois finish; round outline; good stem and branching; carries from a distance.

Sidi-bel-Abbes. 4 ft. July. All segments even tone deep rose-red; no zone; wide yellow throat; round outline; good form and substance. Named for the Algerian city, the home of the French Foreign Legion.

Introduced by Ralph M. Schroeder, Warrensburg, Ill.

Knighthood. (*Dominion* x *Kraus'* seedling). Velvety blackish crimson; throat orange with orange reverse on segments; segments wide; flowers 5½ to 6 inches across, up to 54 on a four foot stem, substance excellent; flowers lasting until after dark.

Introduced by H. M. Hill, Lafontaine, Kan.

Redwood. (*Dominion* x cross of *H. fulva* x *Persian Princess*). Scape strong, erect, many branched; flower red, fragment, 7 inches wide, throat yellow. Color better than parents, not so dark.

Introduced by J. C. Stevens, Greenville, N. Y.

Saladin. (*Rajah* x *Wolof*). Scape erect, slender, stiff, 4 feet high; flower full, recurved, day blooming, 4 inches wide, sun resistant, quick shedding, garnet brown, faint maroon eye.

Introduced by M. F. Stuntz, Williamsville, N. Y. [Originated by *G. L. Mac Alevy.*]

Roger Bacon. Scape erect, graceful, 3 feet; flower full, recurving, 5 inches wide, extended bloom, sun resistant, Ta-Ming yellow, garnet eye, July bloom.

Isaac Newton. Scape erect, heavy, many branched, 2 feet high; flower full, 5 inches wide, wide spread, extended bloom; petals tapestry red, sepals antique red, apricot midstripe in petals. July bloom.

Introduced by Four Winds Nursery. [Originated by *G. L. Mac Alevy, Snyder, N. Y.*]

Charles Darwin. Scape erect, graceful, much branched, 30 inches high; flower full, wide spread, day blooming, 3 inches wide, petals Burmese ruby, sepals same overlaid on Chinese yellow, sun resistant, July blooming.

Thomas Huxley. Scape erect, graceful, few branches, 3 feet high, flower starlike, wide spread, day blooming, 5 inches wide, Chinese yellow, July blooming.

Four Winds. Scape erect, slender, stiff, 30 inches high; flower starlike, wide spread, day blooming, sun resistant, bright red. July-August blooming.

Introduced by Mr. and Mrs. E. A. Taylor, Sharon, Mass.

Gilt Edge. (*Wolof* by red seedling). Scape erect, stiff, many branched, 4 feet high; flower starlike, wide spread, extended bloom, fragrant, 5½ inches wide, dark red, July and August bloom.

Introduced by Mrs. J. F. Emigholz, Cincinnati, Ohio.

Bold Warrior. Scape 40 inches. Broad overlapping petals, yellow overlaid Brazil red and garnet brown; sepals slightly flushed Brazil red; general effect, a rather bright Brazil red bicolor. July-August bloom.

Brick Rose. Scape 36 inches; flower 5½ inches wide; petals over one inch wide, vinaceous rufous, over antique red, with coppery overglaze and edge; throat deep chrome. May be described as a terra cotta with rose undertone. June-July bloom.

Flaming Glory. Scape 50 inches; flower 7½ inches across; petals 1½ inches wide, orange chrome, the crinkled edges touched rose; sepals lightly flushed orange rufous; a velvety flushing of English red over the flower deepening at the center; throat cadmium orange. A glowing dark scarlet with orange underglaze. July-August bloom.

Gold Coast. Scape 40 inches high; flower 7 inches across, petals 1½ inches wide, overlapping, deep orange gold. Widely branched with many buds. July-August bloom.

Luscious. Scape 44 inches; flowers nearly 7 inches wide, wide open, slightly recurving, petals 1½ inches wide, yellowish apricot with faint flushings and a banding of Etruscan red; throat lemon yellow, green at base. General color banded rosy light terra cotta of great charm.

Introduced by Robert Schreiner, St. Paul, Minn., [Miss Eleanor Hill, Tulsa, Okla., originator.]

Browneyed Susan. (*Chisca* x *J. A. Crawford* seedling). Early-midseason; pleasant golden yellow with markings of rich brown on each petal in the throat. Flowers again in the fall in the warmer parts of the country. 36 inches high.

Introduced by Alton R. Bowen, Pleasantville, N. J.

Aunt Jo. (*Red Bird* x *Miss Houston*). Scape 30 inches tall; petals pink with deeper eye zone; sepals pink; throat yellow. Fades but little in sun. Flower 4¼ inches wide.

Herman Kirscht. Scape 40 inches tall; flower 5 inches wide, petals wide, red, much recurved; sepals smaller, lighter, not recurved; throat yellow green.

Introduced by Hamilton P. Traub and J. S. Cooley.

Monterey; robust, flowers large, (color pattern 12 plus halo on petepalsegs); sepetalsegs Maize Yellow (RHS 607) slightly suffused reddish; petepalsegs near Mandarin Red (RHS 17) with narrow yellow strips in center, and edged Maize Yellow.

Corliss; robust; flower of good size and substance; color pattern semi two-toned distal (no. 3); ground color yellow, upper portions of tepalsegs Coral Pink (RHS o619/2), iridescent in the sun, the petepalsegs deeper colored than the sepetalsegs; narrow orange stripe in center of petelapsegs; throat and lower portion of tepalsegs Indian Yellow (RHS 6/2). Moderately fragrant; early midseason.

Introduced by C. W. Culpepper, Arlington, Virginia.

Adventure (F-4 from Patricia x Stalwart); tepalsegs deep Chrome to Cadmium Yellow of Ridgway; flowers open widely, and tepalsegs are slightly reflexed, margins somewhat frilled; flower scapes 3 to 4 ft. tall; moderately still and well branched; midseason.

Big Glory (seedling of *Ophir* crossed with unnamed seedling); flower is Capucine Yellow to deep Chrome of Ridgway; semi-flaring, large, often having a spread of 7 to 8 inches; flower scapes sturdy and well branched; has same flowering season as *Ophir*, but is an improvement on that variety.

Albedo (complex ancestry, but having *Hyperion* admixture); flowering season is midseason late, the same as *Dorothy McDade*, but differs from it; tepalsegs are light yellow (close to Pinard Yellow of Ridgway), margins moderately frilled; flower spreading with a very short throat (tepaltube) in which there is almost no green; petepalsegs 1 to 1½ inches wide, and reflexed.

Acceptor (San Juan x Theron); sturdy and well branched; flower is Blackish Red-Purple of Ridgway; throat (tepaltube) light yellow; and light yellow line through center of tepalsegs; midseason, flowers opening over a very long period.

Introduced by Mrs. Bright Taylor, Ocala, Florida.

Rubaiyat, Height 36". Evergreen foliage. Flower 7", chimney red (Pl. 5 L 10). Petals 3⅞" x 1½"; sepals 3⅞" x ⅞". Throat star shaped, daffodil (Pl. 10 J 6).

Olive Baldwin, Height 36". Evergreen foliage. Flower round and regular with overlapping petals, 5" standing; basic color terra cotta (Pl. 4 D 12) with darker veining. Very wide petals—3½" x 1¾". Sepals lighter and narrower, recurved, 3½" x 1". Throat shading from sulphur yellow (Pl 10 J 1) to light chrome (Pl. 10 I 1), crinkled texture. Recurrent bloomer in Florida.

3. GENETICS AND BREEDING

COMMERCIAL BREEDING OF DAFFODILS

FRANK REINELT, *California*

Although I have grown Daffodils so far only as a hobby on a very modest scale, I would like to offer some experiences in breeding from the commercial point of view.

Commercial growers are necessarily specialized farmers who prefer to grow fewer varieties consistent in health and demand, as their object is primarily of a remunerative nature unlike that of an amateur who grows them purely for pleasure.

Great strides in development of a better flower have been made by breeders in the past, leaving us excellent material for continuation of their work. Literally thousands of varieties were introduced, only a few of which survived the test and reached popular commercial distribution. The reasons for this can be several. Many times sister seedlings of equal value were introduced under different names, one of which was very successful while the other soon disappeared. The man who controls the stock and launches them on their way has a great deal of influence. Large distributors naturally always push first the material they have most of, regardless of quality, and can popularize to some extent an inferior variety, but in the long run the sifting goes on and unless the new variety is better and possesses health and vigor beyond reproach the curtain goes down eventually.

Each year I notice some varieties disappearing from catalogs of specialists but more new ones showing up. Spectacular new advances are very rare—mostly they are slight improvements or variations of the old form, promising at best only a limited commercial run. The prices for novelties are usually high, being based on quality and scarcity, and the enterprising grower on the lookout for a good new variety is confronted with expensive trying out for himself which of the new varieties has the real goods. One cannot blame the majority for hanging on to the old standbys until competition forces them to do otherwise. A successful commercial variety must possess vigor and health which are the first and most important factors; heavy substance, good form, color and size are next in importance; the last perhaps are refinement and quality. The small garden amateur who is the chief ultimate consumer is not sufficiently educated to see much difference between so many varieties of identical color and form, as for instance yellow Trumpets. Many are more advanced and can afford to pay a higher price for better form, but there are only very few of those who can afford or will pay the high price of a recent novelty to enjoy its perfection. Since it takes a good twenty years from the time its maiden flower unfolded for a variety to be propagated on a sufficient scale to reach the general market, the graduation of price is necessary. During the

twenty years of the stock's passing from hand to hand many are left as casualties by the roadside.

As my education in Daffodils progressed I looked back upon times when I was enthused over a new variety, predicting its future only to change my mind in a season or two because of some factor overlooked in the first rush of enthusiasm. Experience is the only teacher, and one as he goes along becomes more and more critical before passing final judgment.

The most popular in demand and also most developed by breeders are the first five classes of Daffodils, namely Trumpets, Incomparabilis, Barriis, Leedsiiis and Poets. The English breeders who did most of the work maintained fairly strict rules as to form of the individual classes and strove mostly for perfection of form. This of course leads to the problem of great similarity, a complaint often voiced by growers. There is a decided necessity for more variation of form and color, however they should possess pleasing balance and maintain some resemblance to the Daffodil as a whole.

What constitutes good form is a matter of diversified opinion and depends on what one likes or dislikes. I have seen people go into ecstasy over a badly proportioned flower that I kept only for comparison as it had a huge cup with very poor perianth, while they passed up a lovely flower of smaller size near by. Great size has astonishing effects on the majority of people, breeders included; but unaccompanied by other qualities it has passing value only, as one soon gets tired of imperfection. Very large cups can be beautiful if they possess sufficient perianth for background.

Of present varieties in commerce a great many are beautiful and no doubt will enjoy a certain length of popularity before being superseded, but in the multitude there are only few flowers of first class breeding value from which the future progress will arise.

I have tested the majority of the best novelties in search for new and more promising parents. Some of these are very recent novelties, perhaps not sufficiently tried but nevertheless very outstanding.

California conditions of course are not perfect for growing Daffodils with the exception of the very early ones, but those that perform well in poorer conditions have more stamina and consequently are more promising as breeders.

When importing new stock from different localities some varieties do not perform normally often for several years until acclimatized, which is a bad factor from the commercial point of view, while others give normal flowers of their best under any conditions. Those of course are the real goods, having breeding value.

For practical purposes I group the large yellow Incomparabilis together with the Trumpets, as often very slight measurements in length of the trumpet assign their place in a group. The borderline flowers are better balanced usually than the full trumpets, and the majority of the best yellow flowers I choose for breeding are actually Incomparabilis although at first glance one would class them as Trumpets. Since they are the first to bloom of the larger forms, they herald spring and

to the majority of people they are the real Daffodils, which makes them the most important group of any.

After growing dozens of varieties for years I noticed that the class as a whole lacks sufficient substance and width of perianth to back most of the larger trumpets. Amongst the very early varieties none impressed me more than *St. Issey*, a borderline Incomparabilis, deep gold, of good form, fair substance and the tallest stem of any yellow of good quality. It is enormously vigorous and the fact that it is a week earlier than *King Alfred* makes it a strong contender for the first place so long occupied by this old favorite. I have chosen it as one of the best prospects for breeding yellows and the future will tell whether I was right.

Amongst the midseason varieties there are several possibilities. Both *Crocus* and *Trenoon* are of the deepest gold and heavy substance, the first rather short and inclined to stripe, the latter taller but not of as good a form. *Galway*, a newcomer I have had only for two seasons so far, impressed me most of any yellow. A borderline flower of very large proportions, fine form, tall stem and very thick substance, it is the most valuable addition I have yet for breeding yellows. It undoubtedly will make commerce as it is a magnificent garden plant. Another promising flower is *Golden Torch*. A flower with possible breeding value might be *Faithful*, a light yellow Incomparabilis, rather stiff looking but of enormous substance, a factor to be strongly considered.

Amongst the late varieties are the most refined show flowers, all rather short-stemmed and not too vigorous. *Cromarty*, in lighter yellow, and the deeper-colored *Kingscourt*, best of all the *Royalist* children, are perhaps the two finest of the group.

Of the short-cupped yellows the number one breeding prospect is unquestionably *St. Egwin*, as it combines great vigor, tall stem, large size, and beautiful form with the most refined quality of any yellow. Some excellent seedlings have come from it already, heralding a new giant race of Incomparabilis which will possess everything that it takes to make a good Daffodil.

Besides the above varieties I use a number of others for variation of form or other desirable characteristics they may have, but regard them as more or less of passing value only, although some of them may enjoy a certain commercial popularity for a time. Other breeders with different conditions certainly will form different opinions and select different varieties. How fortunate that we are not all doing the same thing as long as the goal remains the same, that of development of better varieties for the future.

White flowers are comparatively recent—little known by the general public but destined to be of great popularity once available in great quantities, and very valuable for florist work. *Beersheba*, the first white Trumpet of good quality, has now been superseded as a breeder; it also is a poor doer, and very short in California. *Tenedos* might still be worth using due to earliness and size, besides it has a tendency to breed pinks.

The most promising breeders are of course amongst the more recent and more advanced novelties. *Brunswick*, one of the earliest Leedsii, with good white perianth and cup edged with lemon ring, is a good prospect for breeding and a chance to succeed commercially, as it makes a beautiful and very lasting garden plant. *White House* may be worth using since it is tall, large and very smooth; if it had more substance it would be a first class variety. The best advance in early whites is perhaps *Zero*, a very large flower of fine form, good substance, and very white. A borderline Leedsii, with fine carriage, transmitting its whiteness to its progeny.

Of the midseason group I treasure *Polindra* a great deal because of its vigor, good form, stem and heavy substance. Performing perfectly season after season, it is an Incomp. with creamy white perianth and lemon cup, a very promising parent for strengthening the clearer whites, which are none too healthy. An intensely white flower of large size and good form is *Ludlow*, rather shorter of stem but certainly worth trying. *Broughshane*, the biggest of the White Trumpets, certainly impresses one with its size and enormous vigor and undoubtedly will have a great breeding value if reproduced in more refined editions.

Amongst the late whites *Cameronian* should have possibilities, being quite large, of fine quality and form. *Samite*, a little smaller, is the finest of the *Mme. Krelage* seedlings, possessing fine form, good substance and very beautiful texture. Since its pollenparent was *Beersheba* it is free from the blood both of *Askelon* and *Naxos*, from which two parents the majority of the finest whites were bred, transmitting a tendency to basal rot to their progeny. It may therefore be a good parent for offsetting this factor.

Mr. Wilson sent me a seedling bred by *Samite* pollen which is the nearest and whitest Leedsii I have yet seen, with a beautiful perianth of substance as heavy as one could wish. Unfortunately the cup is sometimes imperfect, and it is not a good doer so will probably never be introduced, but it is an example of *Samite's* possibilities as pollenparent.

I have omitted a number of good white varieties which either had too many defects or were not sufficiently tried; my object was to mention those which are very white or others possessing vigor, stem, size, etc. which may contribute factors for producing whites with more resistance to basal rot.

Coming to colored flowers, which too are less known since the better examples are quite recent, we have a field which offers great versatility. The yellow *Incomparabilis* and *Barriis* with orange and red cups boast a very large number of varieties. *Fortune*, one of the earliest and largest, has undoubtedly a good commercial future since its constitution is quite faultless. As a breeding plant it has not given anything startling—itself it has only a fair quality, and the cup at best is only coppery orange. What we need is flowers with sharp contrast between the color of perianth and cup, both being of solid tone without fading a great deal. A few are here already and more are coming, but the field has great possibilities for the breeder. Of the *Fortune* seedlings the best I have

seen so far is *Hong Kong*. As large as *Fortune* itself, with shorter but better formed cup, quite orange red, it should have breeding possibility and a commercial future. With the advent of *Carbineer* came thick substance, and although itself it has not much color in its cup it gives excellent seedlings with very strong color and is still a good flower to work with. Mr. Richardson produced a series of brilliant seedlings from it, the best of which today is *Narvik*, not a very large flower but quite faultless in form, with tall stem and perianth of deep yellow with the reddest cup, bordering on crimson. The pollenparent was *Porthilly*, which has one of the reddest cups but rather weaker substance in the perianth. It was a happy combination as *Narvik* certainly inherited the best quality of both.

Other varieties which might have breeding value are *Diolite*, *Trevisky*, *Rustom Pasha*, *Market Merry*, *Royal Mail* and *Royal Ransom*.

The most difficult part of course will be to produce perianths of solid color, not of the transparent fading type of which we have so many now, with cups equally solid whether light orange or darkest red, and sunproof as much as possible. In cups too there is possibility for great variation of form and also frilling, which greatly enhances their value.

The colored flowers with white perianths including *Incomparabilis*, *Barriis*, *Leedsiiis* and *Poets* as a class offer perhaps the greatest possibility of color variation and new forms to be developed.

Pink cups, the newest advance in Daffodils, are still very rare and of inferior quality when compared with other classes. The first of its kind, *Mrs. R. O. Backhouse*, has been in commerce for quite a while but its breeding value is quite limited. To Australian breeders goes the prize for development of better pinks, of which *Pink o' Dawn* and *Dawn-glow* are the best so far introduced. The chief defects of the present pinks are insufficient substance and muddiness of the white color in the perianth.

Perhaps by combining the finest, whitest *Leedsiiis* of today with the *Poet* class one could produce a better base for future pinks. In most cases the pink is of coppery tone; to get real rosy pink one first has to eliminate all yellow, consequently only the whitest flowers, such as *Zero*, *Ludlow*, etc. should be used. From *Poets* or close relatives like the short-crowned *Leedsiiis* which have icywhite perianths there are bound to come colored *Leedsiiis* of good quality and exceptional whiteness, some of which should have the tendency to produce pink. It is a long-drawn-out process but the results should be worth it, and I can't think of any more beautiful combination than snowywhite perianth with clear rosy pink cup.

Another color combination amongst *Leedsiiis* are cups of cheesy buff tone. A good example of it is *Penvose*, with nice frilled trumpet-like cup. *Gertie Millar* produces this coloring some seasons. *Bread and Cheese* is perhaps the best flower of this class, having decided possibilities. Unfortunately the color is dependent on climatic conditions; in moist warm weather it is very good, in dry cold weather it is conspicuously absent. Some day varieties with strong buff trumpets retaining

the color are bound to appear, adding greatly to the variation of the Daffodil as a whole.

White flowers with orange or red cups are represented by a large number of varieties, many of very high quality with good commercial future, but only a small handful have top priority as breeding plants. The improvement most pending is the whiteness of the perianth and resistance to sunburn of the color in cups.

Since they are closer related to the Poets, the majority are late-flowering, with the exception of the Australian *Jean Hood*, which is very early. It is a good flower with fairly white perianth and nicely frilled orange red edged cup. Its breeding advantages are earliness combined with vigor and extremely long stem. Itself it may not make much of a commercial flower but its progeny certainly should. Of midseason flowers, *Hades*, with creamy perianth and cherry red cup, has proved a most valuable pollenparent for color and might still be worth using.

Amongst the late varieties are of course the best advances. *Coronach* and its child, *Matapan*, are the two varieties with the whitest perianths I have yet seen. The whiteness in both is even more intense than in most Poets, perhaps because of heavier substance giving it solidity and offering striking contrast to cherry red cups. *Limerick*, with nice white perianth and flat red corona, is perhaps the best of its type, with a good commercial future, since the color in the cup does not fade or burn.

Amongst the shortcrowned Leedsiiis there are several excellent flowers with high breeding value. My favorite is *Dreamlight*, much like a Poet, with white flat corona edged rosy red; since the yellow is eliminated from the base of the corona it should have a tendency to produce more delicate colored edges with an eventual goal of pinks and rosy red.

One of the most astonishing flowers ever produced, which in combination with Poets and colored flowers should have enormous value is *Green Island*. It has the most symmetrical and finest perianth yet produced, fairly white, of good substance, so wide that it forms an almost perfect circle. The large flat corona is ivory white with a lemon yellow edge. Quite stiff looking itself, nevertheless it offers great possibilities for developing an entirely new race of large flowers with large, flat colored coronas.

Conclusion: On the whole I have mentioned only a few varieties in each class, a decision I arrived at by eliminating point by point and considering every characteristic. The future advance no doubt will come from a very few parents, those that have what it takes to make a first class variety, and breeding the have-nots will give always only secondary quality slated for a very short run when introduced.

I dug my bulbs before I finished this article and after examining them carefully I had to eliminate a number of hopefuls as seedparents and confine them as pollenparents only, and then in a limited way. The White Trumpets and Leedsiiis have large soft scaly bulbs in most cases, subject to basal rot and other diseases. The mortality is high and the

tendency is apparent in their seedlings a great deal. Over half of them disappear during the four to five years after germination before they even bloom. The best smooth and hard bulbs are amongst the flowers with yellow perianths, especially of the earlier group. Breeding a hard smooth bulb should be a cardinal point for those who want to produce good commercial varieties. Personally I decided to use as seedparents only varieties which have the smooth and resistant bulb, and confine the doubtful to pollen only, as the progeny on the average inherits health more from the mother than the father.

The future certainly should bring us more vigorous, healthier and more beautiful varieties than we have now, as was the case in the past. The possibilities are unlimited; some day we shall have all those combinations of which we dream today. All it takes is imagination, lots of hard work, and long waiting—then when you get it, it will be already obsolete, because by that time you certainly will want something better, again created by your imagination.

PRODUCTION OF NEW NARCISSUS

EDWIN C. POWELL, *Maryland*

Although more than 7,500 *Narcissus* clones have been registered with the Royal Horticultural Society the production and introduction of new clones seems endless. Thousands of old clones have gone out of existence or are no longer obtainable and thousands of others have been superseded by better ones. Fortunately for amateur growers and the trade many of the newer kinds make their bow and soon pass on because they are not adaptable to either widespread popularity or cultivation. Some that succeed admirably in Europe have proved only commonplace on this side of the ocean.

A few American growers, both amateur and commercial, have taken up the breeding of *Narcissus* and have produced some outstanding clones. I was led into it nearly 25 years ago by a conversation with the late Dr. David Griffiths who, for many years, was in charge of the bulb investigations of the United States Department of Agriculture. I had then a collection of about 75 good popular clones, and he said to me: "Why don't you try breeding? What we need is good varieties produced in America and better adapted to American conditions." And so I began to cross the best clones that I had and each year added a few of the newer introductions that were promising as parents. Since 1925 I have made more than 5,500 crosses and produced more than 60,000 seedlings from which I have retained 70 for breeding, further testing, or introduction.

The aim of all breeders is, or should be, to produce clones that are superior to others in one or more important characters. If they are to become popular they must have strong constitutions, vigor, excellent substance, clear color, good form, and adaptability to grow well under

different conditions of soil and climate. Amateur growers especially are interested in new clones that will fill in the gaps in the flowering periods—later trumpets and earlier flowering Barriis and Poets.

The usual flowering season of *Narcissus* in most gardens covers a period of four to six weeks, but through a better selection of species and varieties it may be extended to eight or ten weeks. The first flowers



Fig. 164a. Hybrid *Narcissus*—*Katonah*; raised by Edwin C. Powell, Rockville, Maryland.

of *Chicopee* and *N. cyclamineus* opened in my garden on March 5 and 6, 1946, and the last ones, *N. recurvus* and *N. albus plenus odoratus*, faded on May 15. In 1947 the first two opened on March 25 and 26 and *Jonquilla Helena* was still in flower on May 27. A difference in the two seasons accounted for the difference in dates—1946 being unusually early and 1947 correspondingly late.



Hybrid *Narcissus*—two seedlings from the cross, *Tantalus* x *Jonquilla*. Photo by Edwin C. Powell.

One of the earliest most successful crosses was *Bernardino* X *Fortune*. From it I obtained 87 seeds and planted out 62 bulbs two years later. They produced a lot of fine yellow *Incomparabilis* with red or orange-red crowns from which I selected *Forber*, *Nansemond*, and *Pocahontas*. Some years ago I used the pollen of the species *Jonquilla*



Fig. 165. Hybrid *Narcissus*—*Crystal Queen* X *Triandrus albus*; raised by Edwin C. Powell, Rockville, Maryland.

and *Triandrus albus* on quite a few clones (Fig. 165). The pollen of these is very potent. *Jonquilla* on yellow Trumpets or *Incomparabilis* generally produces yellow flowers of pleasing form and good substance, but on a white flower it may produce a white or cream-colored Jonquil hybrid. *Cheyenne* and *Kiowa* are two of this color, the former being particularly prolific.

Although *Triandrus albus* was used on several classes of flowers the best results were obtained from the Leedsiiis. Most of the seedlings were pure white and useful as garden flowers and for making arrangements because of their informal shape. However, I have two tall whites that appear promising, one good yellow, one with a primrose cup, and *Oconee* which has a flaring light yellow crown and produces two or three flowers on a stem.

Two outstanding clones are *Chicopee* and *Hiawassee*. The former is from *Obvallaris* X *Cyclamineus* and is the first variety to open, coming out either a day before or behind *Cyclamineus*. *Hiawassee* came from *Cassandra* X *Paper White*, grows 12 to 15 inches high and produces several small white flowers with pearl-colored cups on a stem.

Flowers that have a wide appeal and commercial possibilities have received the most attention. Other than *Hiawassee* no attempt has been made to produce Poetaz clones, and there have been few seedlings in the Barrii class. There has been a goodly proportion of Trumpets, large-crowned Leedsiiis, some Poets, and a superabundance of Incomparabilis.

The production of seedling *Narcissus* has had its pitfalls and tragedies. About half of the crosses fail to set seed, and about half of the seeds fail to sprout, or the seedlings to reach flowering size. A tiny flower was produced by a *Cyclamineus* bulb the third year in a pot. A few flowers are thrown by fourth-year seedlings; about 50 percent bloom the fifth year and half of the others the sixth year. Bulbs that do not flower by the sixth year are now discarded as none had ever produced a worth while flower. The finest white Trumpet that I ever saw was noted one year in the seedling bed, duly marked, and then increased to four bulbs; all died before the next season. A tall and very large small-crowned Leedsii was increased to a dozen or more bulbs and then lost—a careless laborer when digging them placed the label in the lot behind it (which was discarded) instead of the lot ahead of it.

The technique of breeding is simple and easy to practice. Clones that are exceptionately good in one or more characters are selected as parents to be mated with equally good ones with the hope of intensifying some character, overcoming some weakness, or obtaining an earlier or later flowering variety—*Chicopee* as an example on the one hand and *Nakota* (the latest of the large-crowned Leedsiiis) on the other. The late Rev. G. H. Engleheart said: “The male is prepotent in determining both the form and color of the hybrid. In color this is most marked.”

Early in the morning as the flowers open, in some clones before they open, the anthers are removed with the fingers or tweezers. Any that are wanted for their pollen to be used on later flowering varieties are placed on three-inch squares of leadfoil and when dry the foil is folded and placed in a coin envelope. As soon as the flower is deanthiered, or shortly afterwards, the pistil is daubed with pollen, the bud sheath folded back, and a small stringed price tag, on which is written the number of the cross, is looped around the stem just below the ovary. The cross is recorded in the record book in which there are two extra

columns for the number of seeds gathered and of bulbs planted two years later. As the pollen is not wind-bourne and few insects visit the flowers there is little chance for stray pollen to fertilize the flower if it is promptly pollinated upon opening.

The seeds are gathered as they ripen and planted as soon as possible, those from each cross in a flowerpot in which is placed a metal tag with the cross number stamped upon it. The pots are plunged to their top in a frame where they remain until the bulbs complete two years growth. When the seeds begin to sprout in late winter the frame is covered with glass sash to prevent alternate freezing and thawing and the consequent heaving which would throw out the sprouting seed.

After the tops die down the second year the pots are lifted, the contents knocked out onto a wire screen, and the small bulbs and numbered tag picked out, counted, and placed in small containers (paper drinking cups) until planted out in rows in the garden. A hole is punched in the tag which is hung on a 12-inch No. 12 wire and set just ahead of the bulbs. Three or four years later when the first flowers appear the most promising are selected, duly lifted for testing, and to increase the stock for such purposes as may be considered desirable. From the hundreds of seedlings there will be many fine ones and few poor things if good parents are selected. It is a long wait between making the cross and appearance of the flowers, but if some crosses are made each year the time lag does not seem so important after the first crop of seedlings flower.

A FEW NARCISSUS CROSSES

C. W. CULPEPPER, *Virginia*

My interest in growing *Narcissus* from seeds was stimulated by the excellent results obtained by Mr. E. C. Powell in a locality not far from my own. The limited amount of time available for making the crosses and growing the plants to maturity made it necessary to adopt a very simple procedure. Consequently it was decided to limit the crosses to two varieties; *Fortune* and *Dick Welband*. It was thought that crosses of these two varieties might result in seedlings with large red-crowned flowers that would hold up better in this locality during periods of hot weather than existing varieties. As my stock of the two varieties would have to be limited it would be necessary to repeat the cross year after year for a number of years in order to get a sufficient number of seedlings to be reasonably sure that there was a good chance for the best combinations to appear.

To begin the experiment bulbs of each of the two varieties were secured and planted in large pots and kept in an unheated pit greenhouse during the most severe part of the winter. In spite of efforts to get them to flower at the same time *Dick Welband* flowered a few days after *Fortune* but *Fortune* still looked to be in good condition and the pollinations were made both ways. No seed set with either variety. With confidence that a better adjustment of the time of flowering could

be made another season the same procedure was followed the second year. Three flowers of *Fortune* and two of *Dick Welband* opened at nearly the same time the second year and the flowers of each variety were pollinated with the pollen of the other. Again no seed was produced. It was evident that nothing could be accomplished if seed could not be obtained. Without bothering to figure out the cause of the failure it was decided to change the procedure. The bulbs were planted outside in good garden soil. The unemasculated flowers as soon as open were pollinated with the pollen of the variety *Red Cross* and two to four days later the pollen of *Hades* was applied to the stigmas of the same flowers. This very unorthodox method, however, did result in a good set of seed with *Fortune* and a very few seed with *Dick Welband*. The same procedure was adhered to for the following five years. Several hundred seedlings of *Fortune* have now flowered. Only a very few seedlings of *Dick Welband* have been raised to maturity and they have been an uninteresting lot.

The *Fortune* seedlings varied rather widely in many characteristics such as time of flowering, height of stem, character of foliage, and size, form and color of the flowers. A large part of them were red crowned types, many of which might be considered superior to *Red Cross* and *Hades*. Many of them have had much more red in the crown than is the case with *Fortune*. Among the seedlings are individuals that are practically identical to such varieties as *Whitely Gem*, *Damson*, *Rustom Pshaw*, *Fortunes Bowl*, *Fortunes Crest*, *Fortunes Blaze* and *Red Abbott*. I do not consider any of the seedlings to have the all-round excellence and garden usefulness as *Fortune*. Whether any of the seedlings are better suited to the climate of this locality than the varieties already introduced will have to be decided in the future.

During these years the bulbs of these varieties have increased greatly so that I now have an abundance of flowers not only for crossing but for cutting as well. In the meantime I have disposed of sufficient bulbs to return the high price paid for the original bulbs.

The program has been much expanded during the last few years. Some of my own seedlings as well as other *Fortune* seedlings on the market have been used in crosses both ways with *Fortune*. Some crosses have also been made among the yellow trumpets. I would particularly like to secure a very late yellow trumpet superior to those that exist at present. *Lucinius*, *Statendam*, *Megaphone* and *Robert Sydenham* have been used. Some crosses with white varieties have also been made using *Ada Finch*, *Beersheba*, *Kantara* and *Brunswick*. I wait anxiously for these to come to flower.

Although there is a very long wait after crosses are made before results can be seen I think that crossing *Narcissus* will give one as much fun and excitement as can be had from crossing any other flower.

NARCISSUS BREEDING BY AN AMATEUR

W. R. BALLARD, *Maryland*

Two problems confronting the beginner in trying to develop new seedling *Narcissus*, is to determine (1) what crosses will produce seed, and (2) what crosses will result in worth while progeny.

In the first case there is too little authentic data in the literature to use as a guide, and what one does find is not always reliable for his conditions. Whether a particular variety will set seed often hinges on the source of the pollen. I have made repeated attempts to get seed from *Mrs. R. O. Backhouse*. This spring (1947) I tried again with pollen from *Hades*, *Mayflower*, *Central Park*, *Actaea*, *Gallipoli*, *Green Mantle*, *General Pershing*, and *Bulbocodium conspicuus*. The only success was secured in the last named cross—one pod was secured which ripened 3 seeds. Whether these will germinate remains to be seen.

On the other hand, *Lovenest* sets seed rather freely. In my crosses this year good results were had with pollen from *Hades*, *Beersheba*, and *Stresa*. In previous years I have used pollen from *Ada Finch* quite satisfactorily.

As a rule it is not too difficult to get seed to set on *Beersheba*. This spring I used successfully *Ada Finch*, *Lovenest*, *Gertie Millar*, and *Stresa*.

One can sometimes take advantage of abnormalities in seasons to make certain crosses made possible by overlapping of flowering periods which would not normally occur. Generally *Fortune* with me blooms so early that I do not have much of value from which to secure pollen, or suitable varieties upon which to use the pollen of *Fortune*. This spring I secured 5 pods and 30 seeds from *Fortune* x *Ada Finch* and 4 pods and 65 seeds from *Ada Finch* x *Fortune*.

It might be of interest, if I had room, to tabulate all the crosses made showing the varieties used, the number which set seed and the number of seed secured. However, of the 99 crosses made, 50 set seed, and the total number of seeds secured was 2358.

The amateur is often handicapped at first by having limited stocks of the better varieties and this precludes securing large quantities of seeds from particular crosses. Perhaps this is just as well until such time as he can begin to determine which combinations hold the greatest promise. I have been going on the theory that even the experts do not know all the best combinations, so I go merrily on effecting all sorts of combinations depending on the particular varieties which may be in bloom at the same time. If some of them turn out satisfactorily, I shall be content, for one can learn as well from the failures. It sometimes pays to be ignorant for, if he does not know that certain crosses cannot be made, he tries them any way and may have some unexpected successes.

It is obvious that one should start with the best varieties that he

can afford to buy. However, most of the varieties are more or less hybrid in make-up and may carry latent characters which might be expected to appear occasionally from unpromising material.

To the beginner four or five years seems a long time to wait for the first seedling to bloom, but after having possssed himself in patience through this period, the way is happier from then on because he can look forward to some new appearances each year.

The crucial time comes when he must evaluate the new arrivals—to do this satisfactorily he needs to know something of the high standards reached by other breeders. It is only by comparison with the best that exist that the merits of the new seedlings can be ascertained. One cannot hope to buy all the latest introductions or even to visit plantings where they are blooming. One is fortunate if one can have those who are familiar with the advances made by other breeders to look over the new seedlings and to indicate what looks promising. With experience one can learn to form one's own judgments. As with other types of flowers, one will find plenty of good seedlings, but not many that are good enough to name and introduce to the trade. However, there is immense satisfaction, as far as his own garden is concerned, to have some seedling "just as good" even though not better than the best.

If all goes well I shall have my first seedling of the present series in bloom in the spring of 1948. (I did have some years ago a nice lot of seedlings from a cross of *Van Waveren Giant* x *King Alfred*). It will take several seasons, presumably, to get a good line on the combinations having the most promise and by that time one's own seedlings will no doubt enter prominently in the future crosses to be made.

One advantage which *Narcissus* breeding holds for the amateur is that he can raise a large number of seedlings on a relatively small plot of ground. It is not at all difficult to handle the seedlings. With small lots of seed, I use tin cans with the tops and bottoms removed. These are placed in a cold frame and filled with a mixture of sandy soil and leaf mold. The seeds are planted usually in October and covered about an inch deep. Germination is generally good early the next spring. Seedlings are allowed to stay in the cans through two growing seasons, then are transferred to well prepared beds where they are to bloom.

In preparing these beds I like to dig off the first four or five inches of soil and throw this to one side. Leaf mold and a good complete fertilizer is dug into the bottom of the beds, the surface levelled off and the 2-year bulbs put in place about four inches apart. The top soil is then put back to cover them.

Plant breeding is a fascinating pursuit for the appearance of the new seedling in bloom gives an added zest to the art of gardening. There is ample room for many more amateurs to take up this interesting hobby. They may never have the thrill of seeing some fine morning a seedling of theirs so outstanding that it will take its place along with the very best, but they can have a lot of fun just the same—and the *Narcissus* is a good place to start.

EXPERIENCES IN BREEDING NARCISSUS

J. S. COOLEY, *Maryland*

Some years ago I became interested in breeding *Narcissus*. In any breeding program one soon develops certain objectives, and then bends all energies towards getting plants that he likes and that have certain characters which he hopes to recombine in the seedling plants grown from these parents. When one starts to cross these clones having desirable characters one soon learns that many of them will not set seed. Much of the present writer's time and effort in the beginning was wasted trying to use as seed parents clones that do not set seeds. For example he tried to use *Dick Wellband*, *Francisca Drake*, *Firetail* etc., as seed parents, but with failure to get results. In this location there is much better seed setting in some years than in others. Rather than keep trying to get slightly compatible clones to cross it seems preferable to use for seed parents those that will likely set seed even if they do not have all the desired characters. In many cases one will therefore, have to rely largely on the male parent as the carrier of the important character most desired. When one gets some of this progeny to bloom one can then start back crossing and selfing. The experienced breeder perhaps knows what parents are useful for his needs. The beginner may want a list of clones that will usually set seed. The writer has successfully used the following as seed parents: *Love Nest*, *Pilgrimage*, *Alcida*, *Lucinius*, *Horace*, *Sonata*, *Whitely Gem*, *Beersheba*, *Kantara*, *Tunis*, *Damson*, *Daisy Schaeffer*, *Dawson City*, *Alasnam*, *Henry Fielding*, *Obvallaris*, *minor*, *King of the North*, *Fortune*, *White Emperor*, *Gertie Millar*, *Golden Harvest*, *Triandrus Albus*, *Mitlylene*, *Havelock*, and *Stressa*. These clones probably have been used many times in breeding work and the immediate progeny likely will not be different from what we already have. One can however start with such plants having some desirable quality for the objective in view and use the progeny for further crossing and thus build towards the ultimate goal.

A little seed was obtained the first year of my breeding works. There were however many failures. Along with the problem of learning how to obtain seed set was the problem of learning how to grow seedlings with little or no special equipment.

There are many pitfalls in the growing of *Narcissus* seedlings. The early attempts at growing seedlings were sometimes successful but often they were complete failures. The seed was sowed outside and this is probably a part of the explanation for the failures. Several different methods of growing seedlings have been tried during the years I have been interested in breeding *Narcissus*. The seed was sown (1) in a bed outside as soon as harvested; (2) in flats as soon as harvested; (3) outside in flats in November; (4) in a bed in November; (5) in flats as soon as harvested and placed in a cold frame in Nov.; (6) and in flats in a cold frame in Nov. The method that has been most universally successful with our soil and climate has been to sow the seed as soon as

harvested in rich soil in a wood flat 6 inches deep having a hardware cloth bottom. The flat is left outside under a tree till fall when it is placed in a cold frame, care being exercised to keep the seeds moist during the winter months. The seedlings usually begin to emerge in February. By this method of sowing the seed a very high percentage of germination is usually obtained. About May 1 when the cold frame



Fig. 166. Hybrid *Narcissus*—*Canary Twins*; raised by J. S. Cooley, Berwyn, Maryland.

gets too warm the flats are moved out of doors and are plunged in the soil level with the top of the ground. After the tops of the bulbs die down at the expiration of the 2nd or 3rd. summer the bulbs which are often no larger than peas are sieved out and planted in fertile soil in a bed. The bulbs are set 2 to 3 inches apart in rows that are spaced 6 to 8 inches. As soon as they are planted cow peas are sowed over the bed to serve as a cover crop. The bulbs are left here undisturbed until they bloom. In the meantime cow peas are sowed over the bed each year when the tops of the bulbs are about ready to die down. The

rank growth of cow peas serves several useful purposes, namely, it keeps the soil cool, prevents the growth of weeds such as crabgrass, chickweed and other noxious weeds; it also provides humus and helps to increase the soil fertility and also keeps the soil loose and mellow so that cultivation is scarcely necessary.

Most of the bulbs have bloomed after growing in the bed for 2 to 3 years. The total time required from seed to blooming is 4 to 6 years. By this time the plants that are good enough to warrant further observation are removed and kept for further breeding, and the rest are destroyed. In later years the good ones from this lot are put aside for still further observation.

Although there is a long wait of 4 to 6 years before one can see the results of any one's breeding work this should not deter one from engaging in such a project. If one will persist in the work and make some crosses each year and start some new seedlings, one will then have a new batch of seedlings each year to bloom for the first time after the 4th year. Then one perhaps does not realize that the plants that bloomed this year were the result of crosses made 4 or 5 years ago. No matter how low the probability is of getting an outstandingly good flower one is always expecting it to appear—if not this year surely it will the next year. There are usually a number of seedlings that are good—in fact as good as some named clones, but they are not good enough nor are they sufficiently better than the existing named clones to justify introducing them. Of outstanding seedlings selected up to the present time, the following may be mentioned.

Canary Twins (Fig. 166). An outstanding clone. 18 inches tall; umbel of two miniature trumpet type flowers, pedicels upright, ovary and flower only slightly inclined so that the twin flowers are in full view when one stands over them; flowers are for practical purposes a light Canary Yellow (RHS 2/1 to 2/2) self; perianth segments about 1 inch long, Canary Yellow (RHS 2/2), trumpet slightly over 1 inch long, and about 1 inch across at the rim, Canary Yellow (RHS 2/1); moderately

[Continued on page 185.]

4. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION,
IRRIGATION, USE IN LANDSCAPE, DISEASE
AND INSECT CONTROL, ETC.]

NARCISSUS DISEASES

CHARLES J. GOULD *

The narcissi or daffodils grown in commercial fields and amateur gardens in the United States rank among the world's best. Like other flowering plants, however, daffodils are subject to certain diseases which are usually caused by fungi (molds), viruses, or nematodes (eelworms).

Eight diseases occur more or less frequently throughout the United States on daffodils. One of these is caused by a nematode, two (Mosaic and Decline) by viruses, and five (Basal Rot, White Mold, Scorch, Fire and Smoulder) by fungi. The two most commonly found to be serious are probably Basal Rot and Nematode. These eight diseases may often be distinguished by the appearance of affected leaves as follows:

Key to Leaf Diseases

1. Leaves yellowed and stunted, bulb affected with a soft, chocolate-brown rot. (Plate 299) *Basal Rot*
2. Leaves brown and "crumpled" or sickle-shaped as they emerge from the ground, dead areas sometimes covered with a velvety-gray mass of spores. (Plate 300) *Smoulder*
3. Leaves with definite dead tips or spots.
 - A. Spots reddish-brown, most frequent near ground level, appearing after flowering and sometimes causing leaves to collapse. (Fig. 167(1) *Fire*
 - B. Leaf tips dead and brown, sometimes covered with a white mildew-like layer. (Fig. 167(2) *White Mold*
 - C. Leaf tips dead early in season, yellow, red or brown in color and bearing numerous small dark "pimples" (pycnidia); reddish-brown scab-like spots often present below tips. (Fig. 168(A) *Scorch*
4. Leaves mottled in color.
 - A. Yellow-green mottles or streaks scattered on leaves. (Fig. 168(B) *Mosaic*
 - B. Yellow, purple or white narrow streaks, sometimes dead, tan tips. (Fig. 169) *Decline*

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5. Leaves distorted and exhibiting yellow-green pimples (spikkles). (Fig. 170) *Nematode*

In the following pages these diseases are briefly described. Their control is summarized at the end of the article.

BASAL ROT

(Caused by *Fusarium oxysporum* f. *narcissi* (C. & M.) Syn. & Hans.)
[See Plate 299.]

Symptoms

The bulb is partially or entirely decayed with a soft chocolate-brown or reddish-brown rot; shoots arising from diseased bulbs are sometimes stunted, turn yellow and die prematurely.

SMOULDER

(Caused by *Botrytis narcissicola* Kleb.) [See Plate 300.]

Symptoms

Tips of young leaves are crumpled, yellowed or browned and dead; older leaves may be affected with a wet, pinkish-brown rot on one side which makes them sickle-shaped; gray masses of spores are often present on diseased areas.

FIRE

(Caused by *Sclerotinia polyblastis* Greg.) [See Fig. 167(1).]

Symptoms

Flowers exhibit small, watery spots; on leaves the spots are a bright yellow, chocolate or reddish-brown in color.

WHITE MOLD

(Caused by *Ramularia vallisumbrosae* Cav. [See Fig. 167(2).]

Symptoms

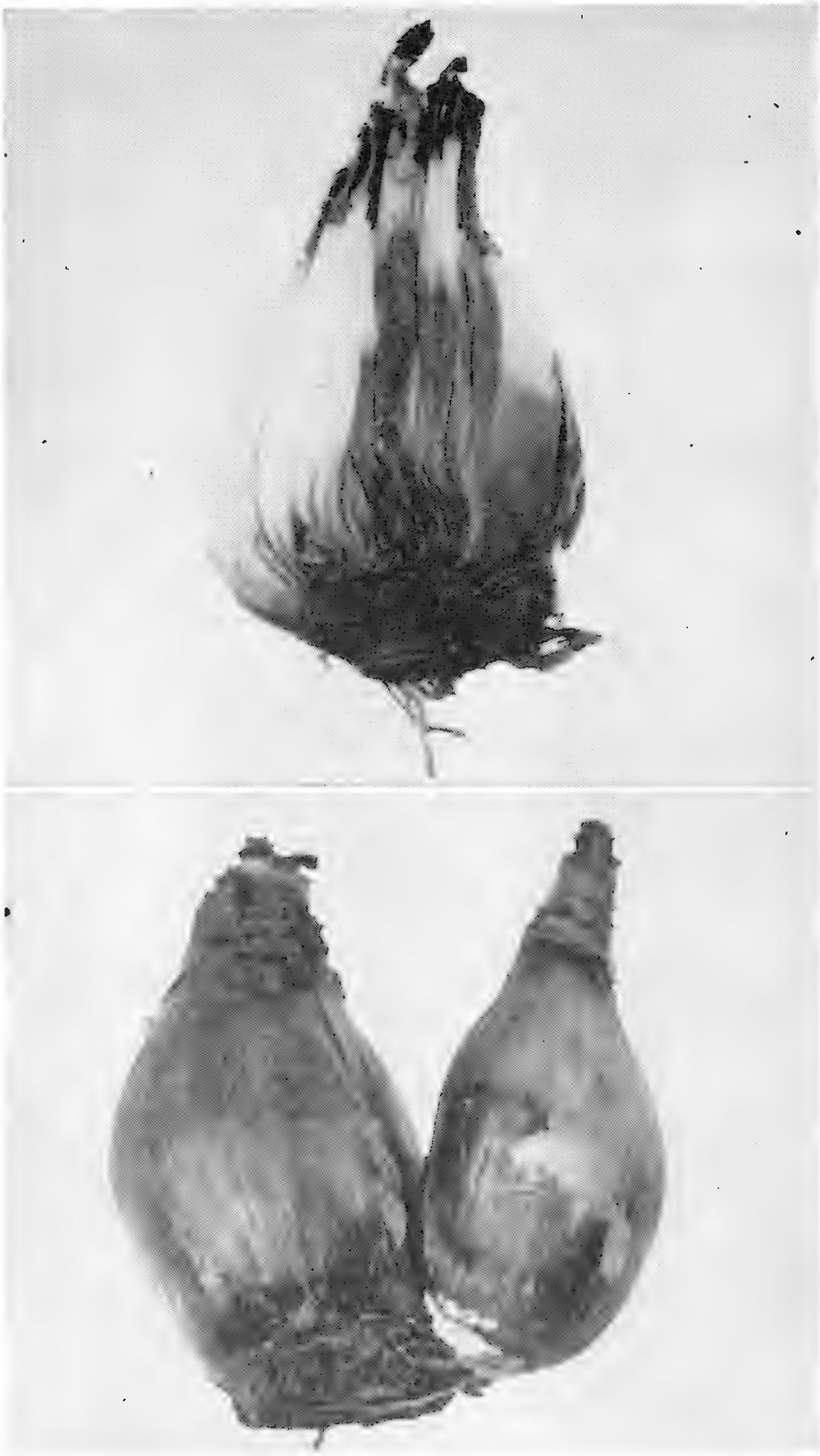
Tips of leaves exhibit sunken grey spots or streaks which become covered with white powdery masses of spores during moist weather. This disease is usually most serious in mass plantings which are left undug for several years.

SCORCH

(Caused by *Stagonospora curtisii* (Berk.) Saac.) [See Fig. 168(A).]

Symptoms

Tips of leaves are dead, yellow, red or brown in color and somewhat wrinkled as they emerge from the soil; reddish-brown, elongated, raised "scabs" sometimes develop below infected tips. This disease is also



Basal Rot of *Narcissus*

most serious in mass plantings which are left undug for several years. The same fungus will attack *Amaryllis*, *Crinum*, *Sprekelia*, *Sternbergia* and *Galanthus*.

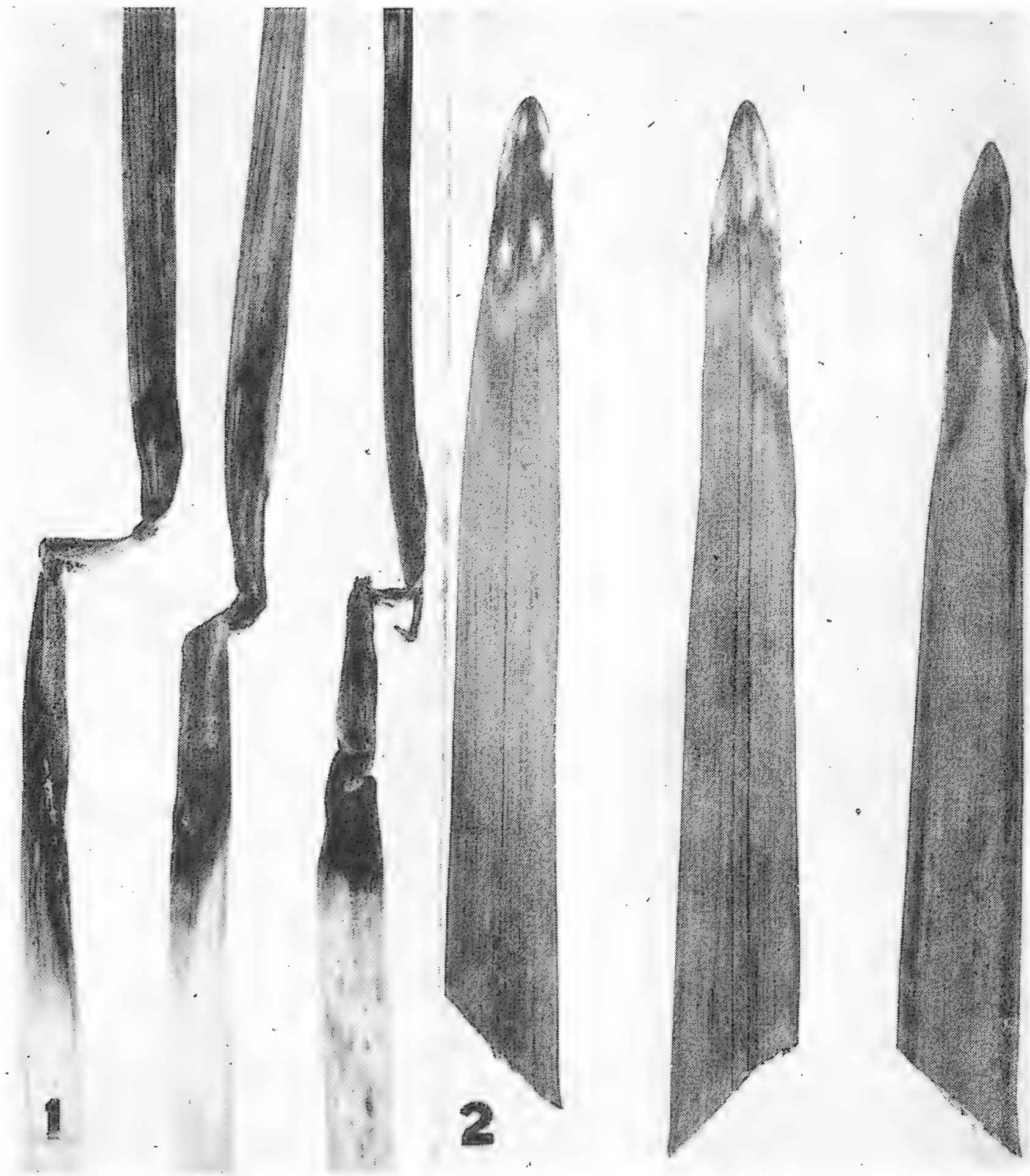


Fig. 167. Symptoms of *Narcissus* diseases— 1, Fire; 2, White Mold.
Photos by Frank P. McWhorter, Oregon State College.



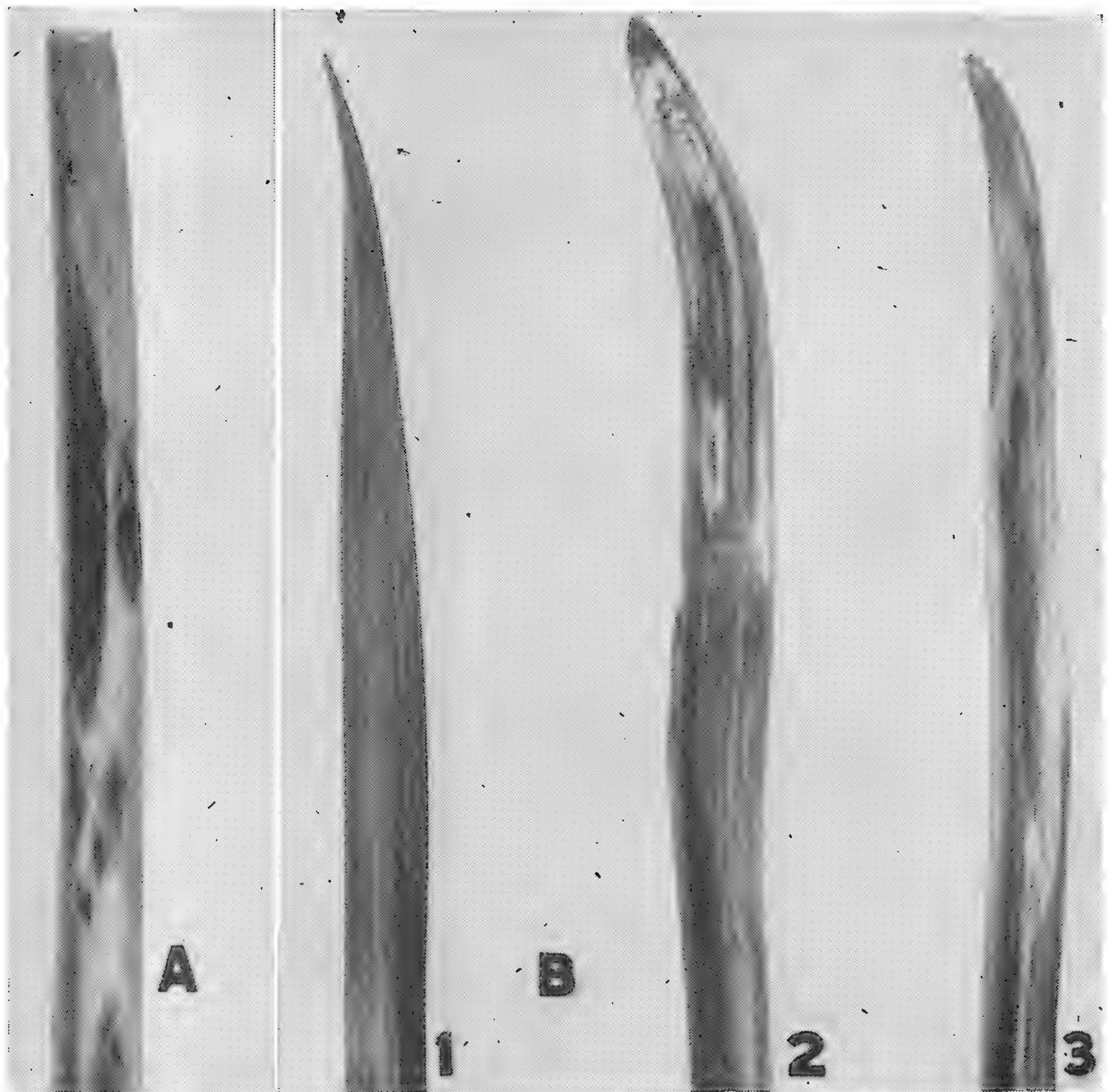


Fig. 168. Symptoms of *Narcissus* diseases— A, Scorch, (Photo) by Frank P. McWhorter, Oregon State College; B-1, healthy *Narcissus* leaf; B-2 and B-3, leaves showing Narcissus Mosaic symptoms.

MOSAIC

(Caused by a virus) [See Fig. 168(B).]

Symptoms

Plants are stunted; leaves exhibit light green, grayish-green, yellow or brown stripes or mottles and may be twisted and slightly roughened; flowers exhibit small white streaks or blotches. This disease is most evident before flowering time.

DECLINE

(Also called White Streak. Caused by a virus) [See Fig. 169(2).]



Fig. 169. Symptoms of *Narcissus* diseases— 1, Purple Streak; 2, White Streak; and 3, Papertip.

Symptoms

Leaves exhibit narrow dark green or purple streaks, which often turn white, yellowish-white or gray as the leaves mature; the tip of the leaf frequently turns yellow and dies. This disease is most evident after the time of flowering.

BULB OR STEM NEMATODE

(Caused by *Ditylenchus dipsaci* (Kuhn) Filip.) [See Fig. 170.]



Fig. 170. *Narcissus* nematode disease symptoms— 1, in bulb; 2, in leaf. Photos by W. D. Courtney, Associate Nematologist.

Symptoms

Leaves may be twisted, distorted and exhibit (1) corrugated leaf thickenings near bases of leaves; (2) marginal discolorations; and (3)

pale yellow or yellowish-brown pimples (spikkles). Infected bulbs may be completely rotted, or show one or more rings of brown, disorganized scales lying between white healthy ones. The early stage of the disease starts with yellowish spots in the neck region, whereas basal rot, with which it might be confused, usually begins at the base. This disease is worse in warm climates than in cool ones, such as the Pacific Northwest.

CONTROL MEASURES

Control measures for the various diseases may be summarized as follows:

Leaf Spots

(Smoulder, Scorch, Fire and White Mold)

1. Dig bulbs every year; clean and replant in a new location.
2. If leaf spots are commonly troublesome, disinfect bulbs according to directions given for basal rot control.
3. Avoid planting in locations with poor air and soil drainage; practice wide spacing of plants and clean cultivation.
4. Remove and burn infected leaves; destroy all foliage when mature.
5. If, despite the above precautions, leaf spots continue to be serious, spray plants at two week intervals with 4-4-50 Bordeaux (for small amounts use 4 ounces of monohydrated copper sulfate, 6 ounces of hydrated lime and 3 gallons of water). Add Penetrol ($\frac{1}{2}$ oz.) or DuPont Spreader-Sticker ($\frac{1}{6}$ oz.) to every 3 gallons of spray solution, to enable it to wet the waxy narcissus leaves. Follow the manufacturer's directions on preparation. Commercial growers often spray their narcissi once after flowering, as a matter of insurance, even when diseases do not appear to be present.

Basal Rot

1. Do not plant any bulbs that exhibit even a trace of rot.
2. Store bulbs under cool, well-ventilated conditions.
3. Dip bulbs (for planting outdoors) for two minutes in a Ceresan solution 10 days after digging. "2% Ceresan" (1 lb. in 8 gals. of water, or 2 oz. in 1 gal.) is recommended in the Pacific Northwest, and New Improved Ceresan (1 lb. in 40 gals. of water, or $\frac{1}{3}$ oz. in 1 gal.) in warmer areas. Dry bulbs rapidly, or plant immediately after treatment.
4. Plant in cool, well drained soil. Avoid soils and fertilizers high in nitrogen.
5. Plant in a new location every year.
6. Dig and destroy in the spring all plants exhibiting yellowed leaf tips.

Mosaic and Decline

1. Try to buy daffodils that are Mosaic- and Decline-free. Patronize reputable dealers.
2. Remove and burn all plants that develop symptoms. Look for Mosaic before flowering and for Decline after flowering.
3. Protect seedlings (from aphids, which carry the viruses) with fine-mesh cheesecloth cages.

Nematode

The bulb or stem nematode is controlled in the Pacific Northwest by rotation and by treating bulbs (several tons at a time) every two or three years in a hot water bath (110°-111° F.) for four hours. Formaldehyde solution is added to this bath in the proportion of 1 pint to every 25 gallons of water.

Naturally this procedure would not be practical for the average amateur, so the following measures should be tried:

1. Try to buy daffodils that are nematode-free. Patronize reputable dealers.
2. Remove and burn all plants that develop nematode symptoms.

Most of the control measures listed herein are intended for the amateur. Commercial control measures are discussed in detail in a Bulletin No. 480, "Narcissus Diseases in Washington," published by the State College of Washington (Pullman, Wash.) in Nov., 1946.

I am indebted to many persons for their assistance in preparing this article, and especially to Dr. F. P. McWhorter (Plant Pathologist of the Oregon Agricultural Experiment Station and Agent of the U.S. D.A.) and Mr. W. D. Courtney (Associate Nematologist of the Division of Nematology, Bureau of Plant Industry, U.S.D.A.). Dr. McWhorter furnished photographs for Figure 167(2), taken from the Oregon Station Bulletin #304, 1932; and also for Figures 167(1) and 168(A); Mr. Courtney furnished photographs for Figure 170.

INSECT AND MITE PESTS OF NARCISSUS

E. P. BREakey *

The statement that the *Narcissus* has fewer insect and mite pests than many of our well-known ornamentals would seem to be in keeping with the facts. This does not mean, however, that these pests of *Narcissus* are any the less important considering the damage they do. Perhaps it means that those of us who are concerned with controlling the insect and mite pests of *Narcissus* can concentrate our attention more fully on a smaller number of subjects. It might be of interest to note that these pests of *Narcissus* are limited to a few species of flies and two species of mites. However, one of these flies, the *Narcissus* bulb fly, probably does more damage than all the others put together.

THE NARCISSUS BULB FLY

The adult of the *Narcissus* bulb fly resembles a small bumblebee somewhat in appearance. It is a shiny yellow-and-black fly whose body is covered with rather long and coarse hairs. The adults are active fliers and prefer sunny locations. Flight among the plants is somewhat zigzagged and usually about eight to ten inches above the ground. Their flight is also characterized by a peculiar high pitched hum when they are most active during warm sunny weather. They apparently dislike the wind for they usually are found in sheltered spots. The adult flies feed on pollen and nectar and will leave the host plants in search of this food.

The *Narcissus* bulb fly is thought to have been a native of southern Europe. It appeared in the bulb producing areas of northern Europe early in the nineteenth century. The insect was reported as present in the United States as early as 1879 and in Canada as early as 1903. This fly is now definitely established in the major narcissus producing areas of the United States.

Damage to the *Narcissus* results from the feeding of the maggots or larvae in the bulbs. Infested growing bulbs produce fewer leaves than normal. That is, if the bulb is not too seriously damaged, it may produce a few leaves. These are usually rather small and grassy in appearance. Infestation in bulbs to be planted may be detected by examining the bases. Cleaning away the soil and old roots with a knife will aid in this examination. A brown colored sunken portion of the root ring which surrounds the base indicates the presence of a maggot. This deep brown discoloration often extends upwards on the side of the bulb above the point of attack. If the bulbs fail to grow, it is probably because the maggots have injured them severely enough to have killed them. Such bulbs are soft, discolored and often in an advanced state of decay. An examination of such bulbs will disclose a large whitish or yellowish-white maggot inside the bulb feeding on the plant tissue.

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The *Narcissus* bulb fly is known to attack *Narcissus*, hyacinths, *Amaryllis*, *Galtonia* and several others. In addition, the writer has also reared the *Narcissus* bulb fly from infested bulbs of the following species: *Cooperia pedunculata*, *Hymenocallis amancaes*, *Chlidanthus fragans*, *Sprekelia formosissima* and *Pancratium maritimum*.

Adult flies begin to appear in late April and are present into June. The peak of adult activity is in mid May. The eggs are laid singly on the bulb leaves at approximately ground level and occasionally in the soil close to the host plants. The newly hatched maggot moves downward between the soil and the surface of the bulb to the base of the bulb where it enters and starts feeding. The larvae are well developed with the approach of winter and remain in an inactive condition in the bulb throughout the winter months. The normal life cycle is completed in one year.

The mature larva has a length of five-eighths to three-fourths of an inch. On reaching maturity the larva leaves the bulb in the spring and moves upward through the soil to the surface where it pupates. The pupa is the transitional stage in which the insect changes from the larva to the adult fly. The skin of the mature larva hardens to form the covering or puparium within which the transformation occurs.

CONTROL

The only satisfactory method for controlling the narcissus bulb fly is to lift the bulbs as soon as they are mature, clean them, and fumigate them, after which they should be returned to the soil promptly. Unfortunately, no sprays have yet been devised that will give reliable protection. Both cyanide and methyl bromide are used in the fumigation of narcissus bulbs. Successful fumigation requires adequate equipment. This means first of all that the grower must have access to a fumigating chamber that has been constructed for the purpose. Most commercial growers have this equipment and use it in a routine procedure. The problem confronting the gardener or the estate owner is quite different. The present methods of control do not lend themselves to the protection of narcissus that have been naturalized in a woodland glade. No really satisfactory field treatment for bulb flies has been developed. Poison bait sprays have been recommended in England, but these appear to be ineffective under conditions in the United States. It is hoped that some of the newer insecticides may prove effective once we learn how to use them.

FUMIGATION

Fumigation with hydrocyanic acid gas is effective in killing the bulb fly larvae within the bulb. The hydrocyanic gas can be generated from either sodium cyanide or calcium cyanide. Calcium cyanide is the most convenient form to use and should be used at the rate of 16 ounces to each 100 cubic feet of fumigator space. The bulbs should be left in the fumigator for four hours at a temperature of 70 degrees F. The fumigating chamber should be gas tight. It should be provided with a heater

and automatic temperature controls and should be equipped with a fan for circulating the gases during fumigation. CAUTION! *Sodium cyanide and calcium cyanide and the hydrocyanic acid gas evolved from them are deadly poison.* Adequate precaution should be observed in using the gas and the materials from which it is generated. Only experienced and dependable persons should attempt to use these materials. The fumigation chamber should be cleared of all residual gas after fumigation before anyone is allowed to enter it. It is not advisable to handle fumigated bulbs until at least 24 hours after they have been removed from the fumigation chamber.

A reaction of the calcium cyanide with atmospheric moisture evolves the gas. This reaction is rather slow and the chemical must be spread out thinly to permit the air to reach all of it. It is advisable to apply the material by spreading it on paper on shallow pans or trays which are placed on the floor of the fumigation chamber. At the end of the fumigation excess material may be rolled up with the paper and disposed of.

Methyl bromide can also be used for fumigation. It should be used at the rate of three pounds to 1000 cubic feet of fumigating space. The bulbs should be given an exposure of four hours at 70 degrees F. Methyl bromide will also kill *Tarsonemus* mites if they happen to be present, something that cyanide will not do.

HOT-WATER-FORMALIN TREATMENT

Bulb fly larvae in *Narcissus* bulbs can also be killed by immersing the bulbs in water that has been heated to a temperature of 110 to 111 degrees F. for a period of four hours. Commercial formaldehyde solution should be added to the water at the rate of one pint to 25 gallons. This is done to prevent the spread of fungus diseases in the treating bath. The tank should be insulated against the rapid loss of heat and the bath should be circulated through the bulbs during the operation. Some means should be provided for automatically adding heat to the bath as it is lost through radiation or otherwise dissipated.

THE LESSER BULB FLY

Narcissus bulbs are occasionally found in a more or less rotted condition, the decayed tissue containing numbers of maggots. These are the larvae of one of the lesser bulb flies and almost without exception are found in numbers, whereas the larvae of the *Narcissus* bulb fly, with the same regularity, occur alone or singly. There are three species of these flies occurring in *Narcissus* bulbs and all belong to the genus *Eumerus*. *Eumerus tuberculatus* Rond. is the most common of the three species. *Eumerus strigatus* Fallen is occasionally found and *Eumerus narcissi* Smith is present in limited numbers, apparently in certain localities only. These three species are very similar in appearance and habits, so all three can be discussed as a group.

Opinions differ as to the importance of these three species as insect enemies of the *Narcissus*. There are those who claim the larvae are not able to attack normal sound *Narcissus* bulbs, that they are able to enter

only bulbs in which decay or rot has already affected the tissue. It is known that the larvae of the lesser bulb flies can not develop in the absence of certain decay organisms. No doubt many bulbs in which decay or injury may have been only incipient could have been saved if larvae of the lesser bulb flies had been prevented from attacking them. Moreover, the writer has examined many bulbs that have been injured by the larvae of these species which bore unmistakable evidence that the injury was due primarily to the activities of the maggots.

The adult flies are quite different in appearance from those of the narcissus bulb fly. They appear black at a distance but closer examination reveals the color to be a dark blue with profuse iridescence. The body bears three pairs of grayish white marks on the upper side of the abdomen. Both ends of the fly are bluntly rounded giving the body a plump appearance. The adults are somewhat variable in size ranging in length from one-fourth to one-third of an inch.

The lesser bulb flies are known to attack *Narcissus*, hyacinths, *Amaryllis*, onions, *Iris*, shallot and several other plants. The writer has also reared them from larvae infesting bulbs of *Lilium speciosum*.

Adults from overwintering larvae appear in April or May. Soon after emergence the females begin to deposit their eggs in clusters of three to ten or more in the soil close to or on the leaves at the neck of the bulb. Soon after hatching the larvae work downward to the bulb which they enter and in which they develop. As soon as mature they move to the soil surface where they pupate and the adults emerge late in June or in July. In the commercial bulb producing sections the bulbs are being harvested at this time and the bulbs in storage are exposed to the egg laying activities of the females of this second generation. Most of the larvae of this second generation pass the winter as immature larvae. A few develop into adults in August or early in September. A few of these may lay eggs from which larvae will develop that will also overwinter. Adults from both of these groups appear about the same time in the spring, thus there are two complete generations and a partial third annually, though they overlap to considerable extent.

CONTROL

Control measures that have been found to be effective against the narcissus bulb fly are also effective against the lesser bulb flies. In addition the grower might keep in mind the advisability of protecting his bulbs against unnecessary bruises or injuries and of protecting planting stock while in storage.

BULB MITES

Any stock of *Narcissus* bulbs may contain bulb mites. These pests are usually associated with decayed tissue in some form and there is some difference of opinion as to whether or not the mites are primarily responsible for the decayed tissue. In many instances the evidence available points to the mites as being primarily responsible for the decayed

tissue. Plants grown from bulbs infested with these mites turn yellow and present a sickly appearance. The leaves are stunted and the plants will generally fail to produce flowers, or will produce only misshapen ones. Bulbs injured by mechanical means, rough handling, heating or weakened by disease are subject to attack by mites, and it is in such bulbs that the mites are usually found.

THE BULB MITE

The bulb mite, *Rhizoglyphus hyacinthi* Bdz. is the most widely distributed species and is the one most commonly encountered by the bulb grower. This mite will attack nearly all classes of bulbs including *Narcissus*, hyacinths, *Amaryllis*, lily, *Crocus*, and *Gladiolus*. The adult mites are almost as large as the head of a common pin. Their bodies are rounded, glistening white and sometimes there are dark spots on the back. The eight legs are reddish brown and the beak or mouthparts region has a similar brown color. The immature stages resemble the adults in appearance but are smaller and the first stage has only six legs.

The life of the adult mite varies in length from one to two months. Each female may deposit from fifty to one hundred eggs. The eggs are quite large and can be seen with the aid of a low-powered lens. Newly hatched nymphs resemble the more common insects in that they have six legs, all other stages having eight legs. Under certain conditions, probably unfavorable to the species, a heavily chitinized, non-feeding but very active stage known as the *hypopus*, may develop from the six-legged nymph. This stage may last from one to two weeks. *Hypopi* readily attach themselves to insects or other creatures and may in this way be distributed to new and more favorable environments. The mites apparently prefer rather healthy bulbs and are known to migrate through the soil from bulbs in an advanced state of decay to the more attractive ones.

CONTROL

Methyl bromide fumigation will kill the bulb mite. It is doubtful if it will kill all the eggs and it may be that the *hypopi* will be able to stand the methyl bromide fumigation. It has been demonstrated however that the methyl bromide fumigation is very much worthwhile, particularly where the grower is not equipped to use the hot-water formalin treatment. The standard control for the bulb mite is the hot-water-formalin treatment. If this treatment is used for the control of mites in lily bulbs, the time should be reduced to one hour. Iris bulbs will tolerate three hours, provided the bulbs are treated at the right stage of maturity. Inexperienced growers contemplating using this treatment should consult their local authorities. The bulb mite is known to spread rapidly among bulbs in storage. Precautions against this spread should be a part of the routine procedure of every grower.

THE BULB SCALE MITE

Recently a very small mite has been found infesting *Narcissus* bulbs, and because of its habit of working between the bulb scales, it has been called the bulb scale mite. The species is *Tarsonemus laticeps* Halbert. Numerous articles in the literature refer to this mite as *Tarsonemus approximatus narcissi* Ewing. These mites are very small, so small in fact that they are not discernible without the aid of a microscope or a strong hand lens. When present in considerable numbers on the bulb tissue, they have the appearance of fine grains of light colored sand. This mite, like the bulb mite, spreads rather slowly in the field, but also like the bulb mite it spreads rapidly among bulbs in storage. Plants from infested bulbs are discolored and there are scarlike yellowish-brown longitudinal streaks on the leaves and the flower stems.

CONTROL

The same methods that are effective in controlling the bulb mites will also control the bulb scale mites. Growers should take precautions against the spread of these mites in storage and whenever possible, should avoid replanting on infested land.

MAINTAINING SOIL FERTILITY FOR NARCISSUS

J. S. COOLEY, *Maryland*

Most varieties of *Narcissus* give more and larger flowers and in general are much more satisfactory when grown in a humus enriched soil than when grown in a hard poor soil. Obtaining a fertile soil for the initial planting is not easy and the maintenance of such a condition is even more difficult, since the *Narcissus* plot must be given clean cultivation for part of the year. The writer has developed a procedure whereby the soil fertility of a *Narcissus* plot can be maintained or even enhanced during the 3 or 4 years in which the plants remain in the same plot.

The important aspect of the method is to keep the ground covered with a cover crop, preferably a legume when the *Narcissus* plants are not actively growing. The *Narcissus* bulbs are dug and reset every 3 or 4 years. Digging may be done in this location the latter part of June. The bulbs are reset as soon as dug and a cover crop of cow peas planted immediately. This is early enough for the cow peas to make splendid growth by frost time. The next spring after a crop of cow peas has been grown, the soil is free of weeds and very mellow and loose. Practically no cultivation is then necessary and the soil is so mellow that it is a joy to work it. A heavy yield of fine flowers is assured after the cow pea treatment. If more gardeners realized the value of humus in gardening there would be less burning of trash and more use of compost.

The cover crop should be supplemented with mineral fertilizer. Extreme caution, however, must be exercised in its application so as to prevent injury. This is especially true when it is applied at the time when the bulbs are planted. The procedure that has given good results with me is to work well into the soil acid phosphate at the rate of about 500 pounds to the acre (about 1.2 pounds to a bed 5 feet wide and 20 feet long) at planting time. As the tops emerge in early spring a mixed fertilizer as 5-8-5 is applied. This may be followed by one or more moderate applications of the 5-8-5 mixture according to the needs. The skillful use of mineral fertilizer is an important aspect of growing *Narcissus*. It is better however to proceed very cautiously and to under-feed rather than to overfeed. The relative importance of the three usual fertilizer elements N-P-K needs special study for one's particular soil requirements, some soils being low in one element and others in another.

If the *Narcissus* planting is in the flower garden, some flowering plant will need to be used for a cover crop. The common flowering *Portulaca* forms an attractive ground cover which shades the soil and checks erosion. Since *Portulaca* is not a robust grower and not a legume, the fertility of the soil should be kept up by adding compost and commercial fertilizer. In regions where *Crotalaria spectabilis* thrives it may be sowed as the *Narcissus* tops die and it will make a great display of yellow flowers the latter part of the season.

Where *Narcissus* are grown for cut flowers or for breeding purposes, a satisfactory way is to utilize a plot in the vegetable garden where a cover crop for soil improving purposes may be grown the latter part of the summer after the *Narcissus* tops die. In this case the most satisfactory cover crop the writer has used is cow peas (*Vigna sinensis*). Cow peas have several distinct advantages. They make a heavy vine growth from June till frost time. The dead cow pea vines are useful as a winter protection after the leaves are killed by frost. The vines readily rot, so that they do not seriously interfere with cultivation. A thick stand of cow peas prevents the germination of chick weed (*Stellaria media*) seed in late summer. This plant which is so prevalent in rich garden soil may be a very useful winter cover crop where the ground is turned in the spring, but may be quite a nuisance in a *Narcissus* planting where it interferes with the development of the bulbs in the early spring. Also considerable labor is required to clean a bulb bed of a mat of chick weed. Any procedure therefore that facilitates the control of chick weed in the *Narcissus* plot is a boon to the gardener.

NARCISSUS FOR THE SUBTROPICS

WYNDHAM HAYWARD, *Florida*

One of the neglected fields in the creation of new *Narcissus* varieties is the development of new varieties for the subtropics, the lower limits of the temperate zone, and the beginnings of warm climate latitudes.

This is to be noticed particularly in Florida, where the large-flowered daffodil types are not suitable except in the upmost tier of counties along the Georgia and Alabama lines. Over peninsular Florida, a winter resort section which would welcome a generous variety of *Narcissus* types for winter and spring gardens—there are only a few, mostly the *Narcissus tazetta* or Polyanthus varieties.

These Polyanthus *Narcissus* are grown commercially all along the coast from North Carolina around to Texas and in Southern California. They are found in home gardens, where with good culture and care they survive year after year as a splendid bedding and cut flower contribution to the subtropical winter scene.

A few of the Poetaz types of *Narcissus*, which are listed as hybrids between the Polyanthus and Poeticus *Narcissus*, are reasonably well at home in Peninsular Florida. Certain of the jonquils and jonquil hybrids are likewise suited, especially *N. odoratus*, the Campernelle jonquil. Just why these jonquils are at home to an extraordinary degree in the sub-tropics is uncertain, as they are reputed hardy and also well adapted to gardens in the Northern states where severe freezing is experienced.

Several types of jonquils and jonquil hybrids are found in old gardens in the lower South, including delicious little Campernelle single types, more delicate and charming than the common Campernelle jonquils offered by bulb dealers in the North. These have been growing for decades in these old gardens, and have greatly multiplied. They survive year after year without being dug, requiring only to be weeded and fertilized sparingly every year, and divided when too crowded. There are Jonquil hybrids, apparently with Poetaz or Polyanthus *Narcissus*, which also have survived from year to year in the sub-tropical gardens from old time. The Campernelle blossoms are all the same pleasing gold color, and the shape of the miniature daffodil-like flower with its corona, are characteristics. The jonquil-polyanthus hybrids, have the jonquil foliage, mostly, and flowers more like the Polyanthus types.

Names of these old varieties have long been lost. They are variously called, Princess Ann's daffodils, Queen Anne's Jonquils, etc. Anne seems to be a popular name in flower memory.

Of the Polyanthus *Narcissus*, only a few varieties are grown commercially in the United States, mainly *Paper White*, and a few so-called varieties of same, as *Paper White Grandiflora*, *Paper White Supreme*, etc., *Chinese Sacred Lily*, white with an orange cup, and the familiar *Grand Soleil d'Or*, (great sun of gold) perhaps the most attractive of the varieties commonly grown, and highest priced. The bulbs of *Grand Soleil d'Or* are slower growing and more delicately constitutioned.

Another interesting Polyanthus *Narcissus* is *Grand Monarque*, a fine, vigorous and free-flowering type, which many fanciers prefer to all the rest. However, it is later in blooming period than the other three, although reasonably easy to grow and produces large bulbs (up to 22 cm.).

Polyanthus *Narcissus* apparently are not too particular about their soil requirements. They do well in fairly acid (5 pH) to above-neutral soils, possibly liking circum-neutral soils best, although the writer has grown handsome bulbs of *Grand Monarque* in acid soils suitable for Irish potato crops, (pH of 4.5 to 5.5) year after year with good results. The recommended range of pH reading for optimum growth of good bulbs and cut flowers is still to be determined, as far as this writer is aware.

The *Paper White* bloom is pure or ivory white, that of the *Grand Soleil d'Or* is a lovely gold, with slightly deeper orange cup, and *Grand Monarque* has a large lemon cup with creamy white perianth. There are two other varieties sometimes found in America, *The Pearl*, with small, pale lemon cup and creamy perianth, blooming early. It is a vigorous type, usually found as a rogue in *Paper White* plantings, and is thrown out by the hundreds by growers, who claim that its flowers do not hold up as well as the *Paper White* in the cut flower trade. It is slightly more vigorous than the *Paper White*.

During the 20's and early 30's, *Paper White Narcissus* were grown by the hundreds of acres in Florida, Mississippi, Texas and other states of the lower South and along the lower Atlantic coast. The price of *Paper White* bulbs sometimes went as low as \$8.00 or \$10.00 per 1000 for the small sizes (10 cm. up). The large sizes, as 16cm. up, sold as cheaply as \$25 per 1,000. *Grand Soleil d'Or* bulbs were never cheap, bringing \$40.00 to \$60.00 and more in blooming sizes, 12 cm. up to 17 cm.

Since World War II increased the costs of production, and labor difficulties and other conditions curtailed the plantings of Polyanthus *Narcissus*, especially *Paper White* bulbs, these have risen in price tremendously in recent years, bringing as much in past seasons as the *Grand Soleil d'Or* before the war, or nearly so.

There are no large commercial plantings of the jonquil types in the South, so far as known. They are grown for garden ornament, and cut flowers.

The Polyanthus *Narcissus* are grown for garden display also, but mostly for cut flowers. The flowers are shipped by the ton to Northern markets in season, which is midwinter. *Paper White* is in flower in the field at Christmas time, the *Chinese Sacred Lily* follows shortly after and the *Grand Soleil d'Or* comes into its full glory in January and early February. *Grand Monarque* is at its best in February. These dates are approximate in middle Florida, for bulbs planted early in the fall, at least by the end of September.

What Sub-tropical gardens need is the attention of breeders of *Narcissus* to produce more kinds of *N. tazetta* hybrids, the introduction of more types of the *N. tazetta* from warm climates where it is native,

and more attention to jonquil-polyanthus hybrids. The introduction of new types of *N. tazetta* appears to be a most promising field for plant investigation. The species is a varied one, found native widely from the Pillars of Hercules to China and Japan. In all this range there must be hundreds of variations and strains of *Narcissus tazetta* which would bear study in the gardens of the Lower South, either for use in hybridizing or as garden material unchanged.

Paper White is an old variety, the *Grand Soleil d'Or* goes back to the late 18th century, and the *Chinese Sacred Lily* may not be a hybrid at all. *Paper White* seeds rarely in Florida, but *The Pearl* seeds occasionally. *Paper White* under special culture has been known to seed, so hybrids should be possible. Hybridization is a delicate operation, requiring a skilled plantsman for success. The seeds are little black shot-like things, the size of radish seeds or slightly larger, and are slow in germination and growing. Several years would be required to make a blooming size bulb.

The best Polyanthus blooms as observed by the writer in Florida, were grown on bulbs lifted in summer, stored in a warm dry place in the shade until late September, and then planted back in well manured, fertile, moist soil, where the drainage is at least good to fair. Commercial bulbs are "round" bulbs, a condition which lasts only one season. A round bulb planted back in the soil splits and makes a mother bulb the next season, with one or more offsets or "slabs". These offsets are separated from the mother bulb and grown on two or three years to produce blooming size bulbs for commerce. The best blooming size bulbs are 12 cm. size and up, 14 to 16 cm. being optimum for ordinary garden and forcing purposes. Millions of *Paper White* and thousands of the *Grand Soleil d'Or* bulbs are sold annually in late summer and fall by seedsmen, department stores, florists, etc., in the North and South for forcing in the home in pebbles and water, to which this type of *Narcissus* is better adapted than others. Northern florists and wholesale growers force thousands of these bulbs for midwinter cut flowers, as they can be brought into bloom in a cool greenhouse with little heat or trouble, and provide a sweet-smelling, bright cut flower with good stems and excellent lasting qualities in the midwinter season of December and January. By successive plantings, they may be had in bloom later. The greenhouse grown flowers are usually far superior to the field run stock shipped north from the Southern outdoor plantings, but have to bring a high price to meet costs, as the Northern grower has to discard his bulbs after forcing.

Growing the bulbs on an acreage scale in the lower South is not something to undertake on overnight impulse. It is a slow, tedious, painstaking process, involving a large investment of time, labor and money, besides the difficulty of developing markets for the finished product. The bulb production must be efficient and economical to pay production costs and a profit.

It is possible that in the Riviera section of France, and the gardens of Southern Spain, or even in the Scilly Isles southeast of England, there are varieties of *Polyanthus Narcissus* which should be introduced to the United States promptly for trial. John Weathers lists the following varieties of *Polyanthus Narcissus* in his "The Bulb Book", (1911):

"Flowers white, with a yellow or orange corona—*Bazelman Major*, *Couronne Blanche*, *Gloriosa*, *Grand Monarque*, *Grand Primo*, *Her Majesty*, *Laura*, *Maestro*, *Mont Cenis*, *Queen of the Netherlands*, *Scilly White*, *Staten General*, and *White Perfection*.

"Flowers all white,—*Early Snowflake*, *Paper White*, *White Pearl*.

"Flowers all yellow—*Apollo*, *Aureus*, *Bertolini*, *Bathurst*, *Charles Dickens*, *Cupularis*, *Jaune Supreme*, *Lord Canning*, *Soleil d'Or*, etc."

To American *Narcissus* enthusiasts, who have only *Grand Soleil d'Or* in their gardens of all the above listed "all yellow" *Polyanthus* varieties, Weathers' roster of names leaves a strong impression that some plant introduction is very much in order from the *Narcissus* gardens of Southern Europe. The writer makes a sincere appeal to all *Narcissus* lovers knowing of the existence of other varieties of *Polyanthus Narcissus* than are commonly grown in the United States to communicate the news to him at Winter Park, Florida, whether in American gardens or anywhere else in all the broad range of this interesting species.

NARCISSUS CULTURE IN NORTHWEST TEXAS

WILLIE MAY KELL, *Texas*

The *Narcissus* clones now in the trade as a rule do not grow as well here as in other parts of the country. Extremes of heat and drought from early May to late Fall are not conducive to the best growth of north temperature zone bulbs. In the Fall of 1947, there was a temperature of 70 to 74 degrees daily into December. If a location of high shade with no cultivation during the intense heat of summer is possible, many varieties will live and thrive. Where the exposure is to the full force of the Texas sun in the long extreme summer heat, many varieties go down so deep they can not bloom and often split up into small immature bulbs. Perhaps if they were dug, cured, and stored in a cool cellar as required to maintain strong, full tulip bulbs, they might be better grown.

Many of the newer, larger varieties decline. *Diotima* and *Ben Hur*, after three years were smaller flowered than seven year old *King Alfred*. *King Alfred* is climate proof. It is commonly grown around here. But the usual varieties seen in most gardens are the ones handed down from old gardens. Unfortunately most of these old ones are not passed on with any kind of name other than some local "nickname".

February through March is the usual flowering period. However there are some which commence in December and others carry through into April. *Narcissus Tazetta* var. *Paper White*, often buds in December and is frosted in the bud. There is a fragrant yellow jonquil which blooms in December and seems to escape being frozen ordinarily. The

doubles are early but the flowers are practically always blasted by frost at night so they do not mature, although from the next zone south of us they do mature. From Central Texas on South they flower well. *Narcissus odorous Campernelle plenus*, *Twink*, *Mary Copeland* all blast from frost. There is an old one quite common in old gardens with the ridiculous name of "Scrambled Eggs" which is a good flower when it does not blast. There are three sizes of "Honey Jonquils" which never fail, even the severe freeze of this winter did not seem to hurt the flowers. The tiniest one is the first to bloom, starting in late January or the very first of February. It combines so well with the earliest of tiny spring flowering bulbs, especially the lovely fragrant Roman hyacinths, white, blue, and pink or even the purple Southern Belle. The middle size is second to flower, starting before the tiny one is quite through. The largest of the three, though it is a miniature, is the latest. They are so close together that one has to compare the flowers to see the difference in the sizes. "Early Daffodil" is another old variety which is desirable. It commenced to bloom the 4th of February this year, and should be even earlier in less severe winters. It has a white perianth with a pale yellow cup, a charming early flower to cut. *Narcissus Tazetta* var. *Orientalis*, always called "Chinese Sacred Lilies" flowers later than the "Paper Whites", and so usually blooms well. The bulb is quite large and increases so rapidly that, together with the knee-high leaf growth, requires plenty of growing room. Starting with 8 bulbs, in four years there were 15 clumps.

Diotima and *Ben Hur* are early in the big trumpet class, although *King Alfred* accompanies them. The middle to the third week in February is their usual flowering time.

In 1940, *Actaea*, *La Vestale*, *Glory of Lisse* and *Diana Kasner* were planted. Only *Diana Kasner* survived and flowered each year, and has increased enough to separate. However, this location was carefully fixed for a lily bed according to the instruction of the Lily Committee. It proved to be disastrous not only for lilies but most other bulbs and plants for this semi-arid region during the heat and drought of Texas summers here, especially during the war when no man power was available for flower gardens.

An old *Narcissus* called "*Orange Queen*" (but not true to name) is an early variety which does well. However, the most choice of the old ones is "*Swan's Neck*". This a charming flower in a class to itself. It is a strong grower, frost resistant, and cuts well.

In 1941, *Thalia*, *Whitewell*, *Laurens Koster*, *Mrs. Krelage*, and *Solfatare* were planted. *Thalia* flowered each year and has now increased sufficiently that it needs separating. Only a few *Whitewell*, planted in the same location, are now living. Only one *Laurens Koster* has survived, and no *Solfatare*. *Mrs. Krelage* has lived but has not increased and has not always flowered. Two different plantings were made of *Solfatare* and *Mrs. Krelage* and the pattern was repeated with *Mrs. Krelage* living and *Solfatare* dying out completely.

Beersheba, *Fortune*, *Dick Welband*, *Golden Harvest*, *Tunis*, *Daisy Shaffer*, *Van Waveren's Giant*, *Moonshine*, *Johanna*, *Roxane*, *W. P. Mil-*

ner are now being tried. *Triandus Albus* was planted but the severe freeze of this winter blasted the buds, perhaps in a milder winter, this variety may fare better. *Mrs. Backhouse* is a beautiful and choice variety which never fails to bloom, although it is very slow to increase. *Love-nest* is second to *Mrs. Backhouse* in the "pink" class.

There are other old ones but it is difficult to try to describe them with not even a "nickname" to designate them.

There is a distinct need for breeding work with *Narcissus* for this climatic region, and similar areas. Perhaps some enterprising gardeners will take it up as an interesting hobby. There is adequate material to start the experiments.

GARDEN CULTURE OF NARCISSUS IN FLORIDA

JOHN V. WATKINS

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Few bulbs are more at home in Florida gardens than are the polyanthus narcissi. This group, characterized by many small-crowned flowers and broad leaves is quite variable and its botanical status is confused. Suffice it to say that most of the narcissi bearing many small flowers that we grow here are classed as *Narcissus Tazetta*, the Polyanthus *Narcissus*. Exceptionally free from the insects and diseases that frequently spell disaster for many bulbs, these old-time favorites are highly commended.

The variable colors range from the immaculate *Paper White* through various combinations of cream and yellow to deep orange. There are types with single cups and others in which the stamens become petaloid and give a double effect.

Holiday blossoms are produced by early *Paper White*; *Chinese Sacred Lily* comes late in December or in January and this first month of the year usually finds *Grand Monarch*, *The Pearl* and other late polyanthus in flower. From Lake City westward the Campernelle Jonquil, originally found wild in France and Spain is a popular spring-flowering bulb. *King Alfred*, the spectacular large-trumpeted daffodil and even rarer types grow well west of Madison, and though peninsular gardeners may force these temperate species one season, they seldom carry over well in the light sands and warmer winters of central and southern Florida. Poet and pheasant's eye *Narcissus* are usually not successful excepting in the western part of the state.

Narcissus bulbs should be planted between the middle of September and the end of October. For best flowering, select large, round solid, baseball-like bulbs and set them about four inches deep and at intervals four to five times their diameters. Thus they will be in the zone of constant moisture and if you plan to leave them for naturalizing, they will be much better off at this considerable depth and distance. For best results the narcissus planting should be in full sun, as the blooms

will be few, the leaves attenuated when shade-grown. Well drained but fertile beds are needed. All narcissi form blossom buds during the late spring growth, the primordial inflorescences being carried over in storage. For this reason aftercare is most important.

The bulbs should be fed adequately after flowering and then lifted when the leaves turn brown. Store in the garage and discard the foliage and old roots when they separate from the bulbs easily. Leave all the brown protective coat and dust with sulphur to discourage mealy bugs. As with all bulbs be certain that rodents cannot gain admittance to the storage containers.

During September and October tiny roots begin to grow on bulbs in storage, indicating that the rest period has been completed and, given a congenial environment, the roots will elongate rapidly and the tops will begin their annual growth cycle. All types of narcissus that you have had in storage must be cleaned and divided in preparation for planting. Break off the slabs or side bulbs and save the round mother bulbs for setting in the most prominent garden spots, as these will make a notable show in December and January. The slabs can be planted separately in rows in the vegetable or cutting garden where they should assume flowering size in one year.

The preparation of the beds for most kinds of bulbs might be outlined as follows. Choose a spot that is in full sun in which the same kinds of bulbs have not been growing formerly. If the soil is very light, apply about two or three inches of rotted cow manure and turn this under to a depth of some eight or ten inches. If you plan to set your bulbs in drifts as a part of the landscape planting, you will want to make individual planting holes so that the plants will not stand in straight rows. For *Narcissus*, Snow Flakes and hybrid *Amaryllis*, the holes may be a full five inches deep. In the bottom you can drop a small handful of your favorite plant food. This fertilizer should be stirred well and covered with a little earth so that the bulbs do not stand directly upon the salts. Set the bulbs right side up, fill with the regular garden soil and water if you like. No damage will be done if you simply leave the soil unirrigated, but most gardeners feel that they can encourage the plants to establish themselves and grow off to best advantage if they water immediately after planting.

These popular bulbs grow best under a mulch; so after you have finished planting, apply a blanket of leaves some three inches thick over the plot. Walking between the plants will compact the soil, so it is suggested that bulbs be planted in beds or drifts that are narrow enough to be worked from the sides. The mulch should eliminate cultivation, of course, but it will be necessary to pull weeds by hand while they are young and tender.

DAYLILIES IN CENTRAL FLORIDA

MRS. BRIGHT TAYLOR, *Florida*

From early March until Summer is over my daylily "test plot", as I call it, is the most exciting place in my garden—an open, sunny space about sixty feet long and fifty feet wide, bisected by a path and bordered by trees. On one side of the path are all the named varieties I have collected for the last fifteen years and on the other side my own hybrids, the eldest just turned six.

They are planted in rows without regard to their display value and cultivated as one would cabbage. This past year I have used compost exclusively, made the organic way, and I think I notice a definite improvement in size and vigor as a result.



Fig. 171. Hybrid daylily—*Prima Donna*; raised by Mrs. Bright Taylor.

The evergreen types are our best ones, not only because of their decorative foliage in the winter time—important as that is, but also because they thrive in Central Florida, having enough genes in their heredity of *H. aurantiaca* and *H. aurantiaca major*. The habit of recurrent blooming, either a development of our mild climate or a natural characteristic of those types that grow best in it, extends our season and makes us seek less ardently the late bloomers so much coveted by gardeners in the North and Middle West. Almost as soon as the last bud has opened, a brand new bunch of scapes appear—often at three or four distinct times, giving us almost as fine a display in the Fall as in the Spring.

Some one, in speaking of daylilies, has said that they are in color, indescribable, in performance, unpredictable and in the garden, indispensable. I subscribe completely to those sentiments, for no color chart carries the myriad tones and overtones found in some of them. A cloudy

day or a sunny one, a move from one side of the garden to the other, a dry season instead of a wet, will curl or uncurl petals, lengthen sepals, dull or brighten colors and upset all previous opinions of practically any variety you think you know. For that reason I do not like to make a list of favorites; they vary so from season to season. I will, however, list and discuss briefly some that have been outstanding *this year*.

To begin with, our season was ten days late, due to the fact that we had all our cold weather in February. After our first cold day the evergreen foliage that had been so lush and green looked as if a pail of boiling water had been poured over it. The deciduous ones went completely below ground and did not reappear until spring. That definite rest period may account for the fact that some of the unpredictables were better than usual. *George Yeld* bloomed the first time in three years. *Bicolor*, *Dominion*, *Festival* and *Saturn*, all have behaved passably, though, as a rule they cannot be counted upon. These varieties require a rest period in which to build up strength to bloom. They do not get it if our winter is mild and, therefore, dwindle in size and vigor rather than increase. June 17: a bloom on *Afterglow*, the first since 1942.

Among the March blooms that caught my eye none was better than Betscher's *Glorianna* and *Beacon*, a pair I have had but a few years. *Glorianna*, in particular, is a large, showy flower in the deep yellow or light orange class, with a wide shallow throat. It has already bloomed three times.

Perry's *Queen Mary* is a tall, medium sized orange yellow, very nice for the back of the border and a variety that repeats.

Meade's *Chrome Orange* is what its name implies—a good color, a medium tall plant, and an early recurrent bloomer.

Aureole is still one to be cherished. It seemed to like its compost diet very much, for the blooms were larger and finer than I have ever seen them.

Gold Dust, my favorite of the semi-dwarfs, always begins blooming at ground level, as if in so much of a hurry to bloom it cannot wait to grow. In the fall it will have nice scapes with many small, fragrant flowers opening in the afternoon and holding over through the next day—so two sets of flowers are often in evidence.

Winsome failed me this year. I divided it too vigorously—forgetting that the fine-foliage plants dislike to be left as single ramets as *H. aurantiaca major* and other robust fans do. (If you have a problem child—one that never blooms, perhaps you might try leaving it undisturbed for a spell.)

There are three early reds, though Stout's *Zouave* is really a bi-color and quite brown after a season here. Of them Wheeler's *Duncan* is the largest and the best color, since Traub's Victory Montevideo has such an undertone of orange the red color is much diluted. Stout's *Vulcan* and *Baronet* come in early April, both vigorous growers, the former much better in the shade. In this group, too, is Watkins' *Welaka*, mandarin orange on the color chart, something quite indescribably lovely in the garden, but with stems rather lax and too weak for the large

blossoms; worth staking, at that. *Sir Michael Foster*, a large yellow trumpet, still good after forty years, also goes to the back of the border, since it grows quite tall. *J. A. Crawford*, a large, soft yellow; *Sachem*, Stout's deep, glowing red, that stands the sun all day but is rather "leggy", so one should plant a medium grower in front; Hayward's *Marcel*—very large, with stems too weak; *The Yearling*, an evergreen *Bijou*, with clusters of small flowers; *Circe*, a small round, pale yellow; *Soudan*, a fine seed parent, mother of many hybrids; *Dauntless*, still unsurpassed in form and substance; Nesmith's *Persian Princess*, a wonderful dark red that likes our climate very much; *George Kelso*, Dr. Traub's fine bicolor—all these are April bloomers.

By May my garden is like a convention hall—jam packed with so many candidates you want to see and know, it's hard to get around. Wheeler's *Paul Ihrig* was good this year and set seed from every cross I tried to make. The pastel petals seemed more pink, so I used it very often; I liked the form and forgave its lack of branching. Mrs. Finlayson's *Grandiflora* opened this month too—a pale yellow of large size, with frilly petals. It is still blooming and never fails to attract attention, no matter what other favorites our garden visitors have. *Easter Morn* has a nice form and a suggestion of the pink color the kodachrome gets to such a great degree. Traub's *Fred Howard*, grown to a fair sized clump, glows with soft pink tones across the garden, set off by its greenish throat. *Carnival* is still good, brownish red with such a wide, yellow throat it is distinctly different. *Golden West*, one of Sass' best numbers, is a tall plant with many star shaped flowers in a soft yellow. *Linda*, *B. H. Farr*, both pastels verging on pink; *Majestic*, a fine, large orange; *Amaryllis*, vase-shaped, golden yellow, well worth preserving because of its substance; Watkins' *Kanapaha*, a true red without the orange tone; *Mayor Starzynski*, so neat and compact and softly glowing, a good garden type, for the scapes are sturdy and hold well the numerous blooms each day; *Taruga*, a large, lemon yellow, with twisted petals; the *Duchess of Windsor*, lasting far into the night; *Patricia*, crisp and cool and firm, even after full sun all day; *Caballero*, the showiest of bicolors; *Princess*, very pale; *Jubilee*, pale yellow with a dark band at the throat; *Mrs. Austin*, intriguing still, a deep gold cup, quite regular and medium sized; *Wolof*, a brown red that goes well with Wheeler's *Brackel* and *Sabrina* for those that like the shades; *General MacArthur*, brilliant and conspicuous; *Dr. Stout*, large enough and fine enough for its distinguished name; *Port*, a mound of small red blossoms that would be fine in the front of the border; *Ruby Supreme*, too widely known to need my mention here; *Halo*, my favorite of the Wheeler hybrids; *Ohred*, a small edition of "Ruby"—and redder, I think; they come with a rush—so you can see that May is a gala month indeed.

It is now mid-June, with the end still not in sight. Most of Nesmith's fine varieties are still to bloom. *Black Falcon*, *Honey Redhead*, *Dawn Play*, *Autumn Red*—none have opened yet, though last year by this time they were almost finished. The Nesmith varieties that I grow bloom late, on the whole, whether because they are not yet acclimated or because it is their nature, I do not know. 'Swan', Watkins' huge orange,

has responded well to compost and water and is startlingly beautiful. It is not a lily to grow carelessly for it requires good care. Sass' *Moonbeam*, almost white, paler than his *Revolute* or *White Lady*, is a night bloomer and of such fragile substance it must be grown in the shade. Stout's *Rose Gem* is an even, clear old rose with a nice green throat and will bear watching. *Blanche Hooker*, in the same group, shows promise; already it has bloomed three times. *Fantasia* I must confess I do not fancy—like Wheeler's *Victoria*, it is perhaps a triumph for the hybridist, but lacks real garden value, in my eyes.

Among my own hybrids are many interesting colors and forms. The pinks have been my special aim toward which I have made some progress. I am describing a few at this time—with some trepidation, I'll admit, for though they do well in my garden, one never knows how they'll appear in another setting. They may not be able to take the northern winters; they may fade in the Midwest sun, or their colors appear dull in coastal fog. The two described in 1945 *Herbertia*, *Cluny Brown* and *Prima Donna* (Fig. 171), still seem quite promising. *Cluny Brown* bloomed April 22nd for the first time and after a two weeks holiday has started again. The color is smooth and even, the substance firm. *Prima Donna* was in bloom from the sixth of May until a few days ago. Though loaded with seed pods, there are several proliferations and to-day I notice several new scapes are coming up to bloom. They may be, as so many daylilies are, only regional performers; it is the comparative few that do well on a national scale, and only a rare one—like *Europa*—that is universal. Time, alone, gives the verdict.

THE WHEELER DAYLILIES

STANLEY E. SAXTON, *New York*

In mid-May of this year (1947) I journeyed by plane from the still chilly spring gardens of northern New York to Orlando, Florida which was as warm as a hot northern summer day.

I was greeted at the airport by Mr. Ralph Wheeler with whom I was to stay. Gardens were alive with color everywhere; whole fields pink with naturalized phlox, while petunias, roses and all the northern summer flowers were growing luxuriantly. Added to these were azaleas, camellias, gloriosas and many amaryllids, all helping to make bold splashes of color in the gardens.

Mr. Wheeler is an orchid enthusiast and has a greenhouse at his home devoted entirely to these. He also raises *Gloriosa rothchildiana* by the thousands! But my interest was primarily in hemerocallis so early the first morning we started out for his seedling daylily plantings.

The larger portion of Wheeler's daylily seedlings are planted in the Ihrig gardens in Winter Park. Here are several acres of seedlings, plus many beds of selected named varieties. We estimated that there were about 100,000 plants in the seedling portion of the planting. A large share of these were in flower and I have never seen such a stunning show as this large field of daylilies made. I would walk down a path

between the thickly planted beds and see a particularly full petaled rich rose or pink flower over which I would exclaim. Mr. Wheeler would smile and say "Let's look at this one over here", and sure enough there would be a larger or more floriferous plant with flowers of an even purer tone, or better form. To study, classify and evaluate such an extensive planting is in itself a major project.



Fig. 172. Hybrid Daylily—*Martha Washington*.
Photo by S. E. Saxton.

And yet certain of the plants showed such decided improvement in size, color or form that it was immediately apparent that to surpass them would be a very difficult task. Out of this mass planting have come some of Mr. Wheeler's recently named varieties and I am going to take a moment to describe a few of these.

It is hard to pick a favorite but, of all the flowers seen, the one that stands out in my picture memory is *Martha Washington* (Fig. 172). Upon seeing this I at once exclaimed, "A real old rose", and sure enough when we compared it with the color card in the field it was the exact shade of old rose. This flower is medium in size but three or four open flowers to a stem is not unusual. I photographed a stem with four open flowers which had 66 buds! A single stem is almost a bouquet. Picture a bed with fifty plants in bloom. I rate this tops in its color class and doubt if it can be improved.

Nearby was a good sized bed of *Haile Selassie* which made a brilliant show. The flower stems are tall, well branched and the flowers very large. The color is a deep maroon purple, lighted by a bright orange-yellow throat and almost white midbands in the petals. This midband is broader in the sepals, giving a striped effect to the flower. Another very dark flower, but more on the mahogany-garnet tone is *Brandywine*. This is a very rich velvety color. The darkest flower that I saw was one Mr. Wheeler may name *Blackbird*. It is almost black. The petals could be wider but this will come in time.

Like many daylily enthusiasts, I have felt that improvement in the yellow class would be difficult, but Mr. Wheeler has three or four flowers which far surpass others in this class. Probably the best is *Cellini* with very wide, almost circular, overlapping petals like a dutch *Amaryllis* in a delicious light buttercup yellow. A shade lighter, and barely brushed flesh pink is one with long, reflexed, crimped and ruffled petals, drooping a bit lazily. This is very large and a wonderful improvement in its class. Lightest of all is *Juno*, its pollen almost white and, in color, the palest sulphur yellow; a finely formed flower but not a fast grower.

I must mention another flower in the yellow tones which made a lovely picture in a massed bed. This was *Easter Morn*. It is a full flower of deep buff yellow flushed mauve pink and very charming. I saw it in full sun where it held up remarkably well, but I have flowered it myself in partial shade with increase in the pinkish-cinnamon overlay, and recommend such a planting.

Brackel is a winner in its class. It has the faculty of changing its color tone from day to day, ranging from mahogany brown to rosy garnet, and with a deeper eye zone. A large flower, it has a peculiar brocaded effect like broad stitching on the petals, more pronounced on some days than on others. Its variability is one of its charms.

Mr. Wheeler is very fond of *Bobolink*, and while I do not share his enthusiasm, I must admit that this flower had about the best purple tones in its coloring of any of the named flowers I saw. I did not see *Amherst* in bloom, much to my regret, but my kodachromes show it to have more blue in the color than any other daylily.

Most of the named reds were not in bloom during my visit, but I can vouch for *Ruby Supreme* as a leader in the deep ruby class from my own flowering of it. *Ohred* is a somewhat lighter and clearer red but not as large or bold a flower as *Ruby Supreme*. I am looking forward to *Scarlet Sunset* which shows the brightest scarlet tone of any of my kodachromes.

Let us turn our attention for a bit to the Mead Botanical gardens in Orlando. Here there is a large loan collection of Mr. Wheeler's most recent seedlings, some coming into flower for the first time. Very few of these are named but some of the most promising new developments can be seen here.

A bright red bicolor, named *Cornell*, was most effective. The sepals are shaded with the same color as the petals, so perhaps we should call it a bitone. In any case it is the purest red I have seen in this type of flower. *M1-1-12* is a very large, wide petaled, apricot flower which has a tropical luxuriance in its carriage. There were many fine seedlings here but two especially appealed to me: *M6-1-26* was a reverse bicolor, petals light apricot and sepals rosy pink, a large full faced flower, and the second was a light flesh pink flower which I thought the finest I had seen in this color.

Of course, at any given time, all of the fine varieties cannot be in bloom, and I particularly regretted not being able to see *Naranja*, *Cerise*, *Billie Burke*, *Cameo*, *Royal Lady*, *Victoria* and *Tarrytown*, as I had not flowered these in my own garden. *Paul Ihrig*, *Halo*, *Empress*, *Angelus*, *Tom Thumb* and *Sabrina* have all bloomed for me and I rate each highly in its class. I did see the semi-dwarf varieties *Ming Toy* and *Dryad* which have fine color and should fit into the rock garden picture.

To discuss the dozens of fine varieties still under number which I viewed with Mr. Wheeler would take a small volume, and I think it best to close by saying that many fine new flowers are on the way to add to the beauty of our gardens.

DAYLILY TRIALS IN VIRGINIA

GEORGE GILMER, *Virginia*

I have been a daylily enthusiast for upwards of ten years. I am now growing over 150 varieties. These plants vary slightly from year to year. Some require almost full sun to do well; others are better in half shade. Divisions of the same plant in different parts of my garden will vary some as to height, size and a little as to season of bloom. This article must, therefore, be taken as the opinion of one man as to performance in one location.

I am only mentioning those which have performed exceptionally well for me.

DR. HAMILTON P. TRAUB'S DAYLILIES

I have grown since 1944 twenty-five daylilies introduced by Dr. Traub. These daylilies are usually as good in the hot sun of 6:00 P. M., as at 9:00 A. M., on the brightest day: *Carnival*, *Dr. Stout*, *Duchess of Windsor*, *Elaine*, *Emberglow*, *Fred Howard*, *Fire Red*, *Helen Wheeler*, *Lidice*, *Mayor Starzynski*, *Reba Cooper*, *San Juan*, *Victory*, *Montevideo* and *Wekiwa*.

The Traub introductions bloom early midseason and midseason. I wish some were very early or late. The foliage is above average and

excellent on *Mayor Starzyinski*, *Emberglow*, *Queen Wilheminia*, *Fred Howard*, *Peony Red* and *Wekiwa*.

One root of *Mayor Starzyinski* planted in the spring of 1944 was divided into twelve nice plants in July, 1946, averaging as large as the original. This is my record increase. *Reba Cooper*, *Emberglow*, *Victory Taierhchwang* increase rapidly. *Wekiwa*, *La Tulipe*, *Helen Wheeler* and *George Kelso* increase well.

Helen Wheeler is a wonderful pink that holds shape and color as no other pink in my garden. *Emberglow* and *Fred Howard* are top-notch pinks. *Fire Red* is one of the brightest and best reds. *Mayor Starzyinski* is a very free flowering plant with perfectly formed small red blooms leaning towards orange. *Wekiwa* is one of the finest reds that grow. *Lidice* is a fine orange, blooming early and over a long season. *Duchess of Windsor* is a lovely daylily, perfectly shaped. *Dr. Stout* is a beautiful orange with a touch of red. *Queen Wilheminia* is a fine orange with a reddish eye. There are some others such as *John Blazer*, *Golden Glow*, *Berwyn*, *General MacArthur* which are said to be as good if not better than those in my collection. The plant of *Indian Chief* is too small to rate at the present time.

DR. A. B. STOUT'S DAYLILIES

Dr. Stout has introduced many fine varieties. All are offered on introduction at \$3.00 each so there is little chance anyone will not get his money's worth. I grow forty-eight Stout varieties not including ten purchased when first offered in 1946. I generally order whatever he introduces. The following are my favorites:

Princess is a fine large lemon yellow. *Patricia* is one of the finest yellows. *Taruga* is light yellow with long twisted petals. *Wau-Bun* is early yellow with long twisted petals. *Rajah* is large vigorous reddish. *Red Bird* is one of the brightest red. *Vulcan* and *Wolof* are both good maroon varieties but so similar that many people will not want both.

B. H. Farr is beautiful peach and cream, but fades, in the sun. *Aladdin* is early eye pattern of yellow and bronze. *Mikado* is most popular eye pattern, but not as vigorous as many. *August Pioneer* is orange and valuable because late. *Chentu* is late coppery orange red with distinctive foliage. *Hankow* is late yellow with scarlet. *Cabellero* is the best bicolor, pink and yellow.

MRS. THOMAS NESMITH'S DAYLILIES

Mrs. Nesmith has introduced many varieties, including some very good ones. Most are introduced around \$10.00 and many remain in that class for years. For this reason I have not been able to buy them by the dozen as I have no plants for sale but raise them as a hobby. I have seventeen of hers and can recommend the following: *Sweetbriar* is a good pink; *Tara* is a good deep pink, free flowering; *Matador* is a good fiery red, different from most reds, and *Royalty* is a good red.

H. M. RUSSELL'S DAYLILIES

I have 48 Russell varieties, 12 were planted in 1946, and some of the others are too small to rate. Four are among the best grown today: *Annie Victoria*, orange; *Mrs. B. F. Bonner*, like Hyperion but decidedly better; *Queen of Gonzales*, deep yellow; and *War Path*, a red which is not excelled by any.

Russell introduces some at fancy prices which I do not have and are perhaps among his best, and some at lower prices, which I have bought freely. I expect to add about six more of his to my Roll of Honor.

H. P. SASS' DAYLILIES

I have grown three Sass varieties. I recommend *Dorothy McDade* as a fine *late* yellow, not excelled by any blooming at that time.

OLD VARIETIES

Gold Dust blooms very early and does well in considerable shade; *Apricot* is a good yellow, and *Ophir* is the handsomest yellow among the old introductions.

HABRANTHUS BRACHYANDRUS

MRS. W. E. MACARTHUR, *Florida*

These interesting bulbs, members of the *Amaryllis* Family, came into my garden as stowaways in 1937, where they came from, or how they settled in my garden will probably always be a mystery.

Mrs. W. D. Diddell identified them for me and in *Herbertia* 1938 Mr. Walter S. Flory, of Texas Agricultural Experiment Station, A & M College of Texas [now at the Blandy Experimental Farm, University of Virginia, Boyce, Va.] had a fine paper entitled *Cytotaxonomic Notes on the Genus Habranthus* which greatly increased my meager knowledge on the history and characteristics of these bulbs. *HERBERTIA* has been a veritable storehouse of information on the *Amaryllidaceae*.

Habranthus Brachyandrus bulbs were purchased from Oakhurst Gardens for comparison with my colony and they are identically the same, like most bulbs they require a year or so to become established before blooming regularly each season which is June through August in Florida, the scapes coming up over night bearing one bell of lavender pink, having a maroon spot in the throat, they are prolific bloomers sending up several scapes from each bulb, they set seeds easily.

In crossing them with *Habranthus robustus*, the only difference noted in the three bulbs raised is a longer perianth of a deeper blend of pink and taller scape, no markings in the throat. Have tried crossing *Habranthus robustus* with *Zephyranthes grandiflora* (*carinata*) with no results. *Habranthus robustus* is a lovely bulb to own, easy to grow and satisfactory to work with in garden design or artistic arrangements.

One of the most beautiful of this family is *Habranthus cardinalis* (C. H. Wright) Sealy which I imported from Nassau some years ago,

enjoyed them only a short time when they disappeared altogether, perhaps my soil did not contain the correct amount of lime. It may be that the moles and field mice helped to destroy them. As soon as convenient am going to import more of these beautiful bulbs and try again to make them like Florida. This time I will give them liberal amounts of oyster-shell in the soil.

These allied members of the lovely *Amaryllidaceae* help in a large degree to satisfy the longing of Florida gardeners for the hybrid lilioms that our Northern friends enjoy and grow so luxuriantly.

GARDEN CULTURE OF CRINUMS IN FLORIDA

JOHN V. WATKINS,

Assistant Professor, Horticulture, University of Florida

Rivalling all bulbs, surpassing most in their adaptability to Florida, the crinums are widely appreciated by all classes. On the terraces of the Palm Beach estates where they are grown for their huge tropical leaves, in the clean-swept front yards of saw mill shanties where they are liked for their milk and wine, liliom-like blossoms, in the hobby collections of suburban commuters, these giant semi-tropical *Amaryllis* are ever with us.

Among the largest of the true bulbs the huge storage organs will weigh several pounds and they will seek a depth of a foot and a half or more under the earth. Crinums grow rapidly, forming huge clumps from the offsets that are produced in large numbers. Remaining year after year, succeeding in broken shade or full sun requiring no attention save an annual spring feeding, these mammoth Amaryllids are highly commended.

Genetically, the genus is in great confusion, hybridization having proceeded for generations without benefit of vital statistics. Planting stock from different nurseries illustrates this point as bulbs bearing the same names will have different flowers and conversely, the same varieties from different sources will bear flowers unlike each other.

This all adds up to the fact that it is difficult to compile an authoritative list of the best varieties. Probably the best procedure is to purchase bulbs that you like when you see them in bloom.

The modern, strikingly different *Ellen Bosanquet* with the deep rose flowers, the pastel pink *Cecil Houdyschel* will not be confused. The tulip-shaped Christopher Lily and the immaculate *Powellii Alba* are easy to identify by form, but the many garden-variety crinums are irrevocably mixed.

Because of their huge coarse leafless scapes, the inflorescences will seldom serve as cut flowers just as they are, but the individual flowers, when severed at their point of attachment are useful in small containers. In this way too, no buds are sacrificed, as the younger ones can open on the plant to be used later in the house.

POST-WAR AMARYLLIS GROWING CONDITIONS IN FLORIDA

WYNDHAM HAYWARD, *Florida*

Acreage production of the hybrid *Amaryllis*, as a popular florists' and seed store bulb, to be sold mainly in the North in the larger cities as pot plants or in the dry state, has shown an increase in Florida, in the last 10 years, until at the present time there are an estimated 200 acres devoted to this highly specialized horticultural crop in the state.

The State Plant Board is now providing an inspection service for hybrid *Amaryllis* grown in the open field. This service calls for several visits of a State Nursery Inspector to the growing fields, and examination of the bulbs under cultivation for evidence of diseased conditions or the presence of insect pests. A certification is then provided for the grower, similar to that provided for crops of Easter Lily bulbs and Narcissi in Florida.

More than half of the *Amaryllis* acreage in the country is in Orange County, and it is estimated that 3,000,000 *Amaryllis* bulbs are harvested in the Orlando area alone annually. There are other plantings in other parts of the state, as around Ft. Myers and Tampa. In the Orlando area, (Orlando is the county seat of Orange County, important citrus area) numbers of former growers are no longer engaged in growing *Amaryllis*, and the interest of fanciers declined during World War II, when circumstances took many of the growers, amateur and professional, away from their farms, or war-time occupations and labor shortages made it impossible to take care of their bulb plantings.

Because of the War, the National Amaryllis Shows which were sponsored annually by the Society, alternately in Florida and California, have been suspended, and it appears at this writing (1947) that it will be several years before the *Amaryllis* fans can resume these exhibits. A number of the leading exhibitors in the pre-war shows, from 1934 on, are no longer growing *Amaryllis*, or have moved away or have been forced by other interests to let their plantings decline until they no longer produce any quantities of exhibition quality flowers.

Exhibition quality flowers are not something that just happen. They are the result of long-planned preparations, and careful management of a large bulb planting. Most of the growers now engaged in producing *Amaryllis* in Florida are marketing their bulbs on a quantity wholesale basis, merely as bulbs, with no specifications offered as to the quality of the flowers which the bulbs will produce. If they will bloom that is all the seed store or department store counter trade demands, and that is where most of the bulbs are sold. The greater part of the field run bulbs would not be of exhibition quality, or suitable for display in competition at an important flower show.

The price received by growers has reached figures several times that of pre-war years, when 2½-inch diameter bulbs were known to have been purchased by jobbers, field run, at 4 cents each. The wholesale price

of 2½-inch bulbs, the standard blooming size offered in the trade, has risen to 16 to 25 cents or more, at least twice the average pre-war level. Expenses of cultivation, fertilizing and labor of planting, etc., are much higher than before the war. Common field labor in the Orlando area, which received \$2.00 to \$2.50 a day in 1940, is now receiving much higher wages, in some cases \$1.00 to \$1.25 an hour for totally unskilled workers. In the country sections women and less able-bodied men can be obtained for lesser cost, 50 to 75 cents an hour.

A few of the growers are making an earnest effort to improve the quality of their bulbs as to the flowers, by careful selection of parent stock in the growing of new seedlings, and the importation of high priced greenhouse exhibition stock from abroad, principally Holland. The Holland growers seem to have come through the war with their choice *Amaryllis* in better shape than the American growers, as they deluged the American trade with imported Dutch hybrid *Amaryllis* in 1946-47, and have large stocks to ship to America in 1947-48 according to advance catalogues.

The exhibition types of hybrid *Amaryllis* or the bulbs producing this type of the flowers, are usually more delicate in constitution than the common field run of Mead strain hybrids in Florida. Hence plantings of choice stock "go back" or retrograde in the ground or in pots outdoors unless given careful and continuous attention. Irregularities of weeding or fertilizing sends these bulbs into a decline, so that even after former conditions of good culture are restored, it takes several seasons before a planting will be in good condition again. In the meantime one's best bulbs may be lost, as pure whites, pinks, or solid reds of wide, broad-petaled types. These are mostly recent introductions from abroad or from greenhouses in the north,—recent in the number of generations of the bulbs produced under outdoors conditions in Florida.

The writer's commercial planting has suffered this same decline during the war years when he was engaged in editorial work on an Orlando (Fla.,) newspaper, when labor and time were not available for continued attention to his *Amaryllis* planting. Out of some 50,000 bulbs of all ages which produced 10,000 blooms in 1941-42, there were less than a dozen bulbs which bloomed in the spring of 1946, after five years without weeding or fertilizing. In the next few years the writer hopes to be able to restore this planting to pre-war standards, as most of the bulbs are still alive, although reduced in size to half-inch or one-inch diameter by the long period of neglect.

A number of leading growers have imported breeding stock of choice hybrid *Amaryllis* since the war, from such Holland specialists as C. G. Van Tubergen, Ltd., Ludwig & Co., Warmenhoven & Zonen, and Leo Van Grieken & Zns. These imported bulbs arrive in weakened condition, with few exceptions, so that the blooms the first season are inferior or worthless as a criterion to judge the quality of the bulb at its best. In fact in many cases it would be better if the bulb would not be allowed to bloom until the second season, in order to conserve its strength.

This inherent weakness of the Dutch *Amaryllis* bulbs under outdoor Florida conditions is due of course to the fact that the Dutch grow and select the bulbs under greenhouse conditions with more or less the care that other fine plants receive, while in Florida, the average grower plants his bulbs in the ground so that they virtually shift for themselves, and only the fittest under the condition survive.

A few Florida growers pot up their imported stock and use it for exhibition purposes, and breeding, crossing the better types of the more vigorous Florida outdoor strains with the Dutch bulbs, and vice versa. This will produce in a few decades a fine new race of hybrid *Amaryllis* in the case of conscientious growers, which will inherit vigor from the Florida strains and quality of bloom and size, color, etc., from the Dutch bulbs. It will not happen with the first few generations, however, as both strains have been isolated too long. Whether the Florida growers will ever be able to produce a vigorous strain of the pure whites, remains to be seen. In some cases, the Dutch pure white *Amaryllis* will not bloom for several seasons in Florida after the initial flowering. Doubtless cutting off the bloom stalks to prevent flowers until the bulbs are firmly re-established in pots or beds would help this difficulty.

Among large *Amaryllis* growers and dealers in Florida are B. M. Sangster and John Masek. Sangster recently reported he had more than a million bulbs in cultivation on 40 acres, and he indicated that the trade demand for the bulbs was still good. His bulbs are field grown, on Orlando types of the Norfolk fine sandy loams, common over Central Florida. Some of them are interplanted in young citrus groves, to give a few crops of the bulbs while the trees come into production.

One *Amaryllis* grower, A. A. Dobbs, of Orlando, is reported to have grossed \$4,400 annually on 1½ acres of the bulbs, but the average is nearer \$1,500 according to Sangster. One man can care for four acres with proper equipment, he related in a recent interview to the press.

The *Amaryllis* fields are planted from seedlings or offsets, and most of the growers try to grow a few seedlings every year to keep up the variety of their stocks. Every seedling hybrid *Amaryllis* bulb is a different colored and shaped flower under Florida conditions, although they may run to general types. The danger of growing the bulbs from offsets is that fast-multiplying inferior flower types may be increased to an extent that they will crowd out the slower-growing bulbs producing better-type blooms.

Seed are raised by transferring pollen from the anthers of one flower to the pistil of another, using the better types of flowers for parents. Vigor, size of bulb, broad, open petals, clean coloring, light throat, and thrifty root systems are among the desirable factors to be considered in selecting bulbs for field planting seed stock. A field of bulbs producing good quality flowers, even if not exhibition stock, but thrifty, quick-maturing and producing a reasonable amount of offsets to be planted back after the annual digging, is highly desirable from the commercial point of view.

Neglect of this quality angle, and consequent growing of *Amaryllis* bulbs like so many potatoes will prove disadvantageous in the long run,

when additional growers take up the business and competition becomes keen for the sale of the bulbs. The present seller's market cannot be expected to continue for many more years.

IMPROVED LAPAGERIAS AND AGAPANTHUS AT KEW

WILLIAM LANIER HUNT, *North Carolina*

Improved Lapagerias.

On the first day of August, 1945, the writer had the pleasure of studying in the Temperate House at Kew and the good fortune to find Mr. C. P. Raffill, Assist. Curator, in charge of this part of Kew Gardens in his office. We spent several hours together in a rather intense review of amaryllids at Kew since my last visit there in 1927.

Mr. Raffill has for some years been improving that vine of vines the Chilean *Lapageria*, and his seedlings are something to make one gape. He has developed flowers up to four inches in length and with a rather more pronounced silver spotting than in the type with which most of us who have ever seen this magnificent vine are familiar. The color of the seedlings, too, seems a more intense pink.

Lapageria is, of course, not exactly what one likes to call a vine but rather a graceful twiner. Its broad, evergreen foliage is almost beautiful enough to justify its cultivation, and the flowers then, place it at the top of the list of semi-evergreen, flowering twiners.

In an article, "A Report to Home Gardeners", written for the magazine *Home Gardening* in April, 1946, this writer mentioned the fact that one could find, here and there, in old, heatless green-houses over the South, a fine specimen of *Lapageria* and that it should be grown in the patios of New Orleans. The May number of *Home Gardening* carries a response from Mrs. Walter B. Price in which she says that the vine is grown successfully there.

Agapanthus.

During my study at Kew last summer, one of the amaryllid groups under close observation was, very naturally, the collection of *Agapanthus* species and the seedlings which Mr. C. P. Raffill, Asst. Curator in charge of the Temperate House, is growing from his crosses. His white "Somerset East" is one of the showiest of all *Agapanthus* varieties. The huge heads of flowers are of that dramatic character that make the variety one that will be permanent for a long time, certainly. To this writer's eye, it is a white, improved *A. orientalis*, though my notes do not indicate the parentage.

Huge tubs of crowded plants of various agapanthuses are set outside in summer. Showiest of all, of course, were the above-mentioned white variety and the tremendous *A. orientalis*. We examined the curiously leggy *A. caulescens*, and, of course, *A. pendulus*, with drooping,

intensely dark blue flowers. The latter can be seen in the *Botanical Magazine*.

In reference to the flower beds in front of the water-lily house, my notes have the following, scribbled enthusiastically in the usual English shower:

“Bed of *A. umbellatus* edged with *Zephyranthes candida* would be gorgeous with complete ground-cover of the *Zephyranthes*—blue above white. In the bed are, also (in front of the 6-inch taller *A. umbellatus*) *A. umbellatus* var. *Mooreanus*, but they have just finished flowering.

Suggest bed of the two mixed, i. e., spread over the whole bed—also some of the white ones of each. Seed heads and stems should be removed for tidiness as soon as the *Mooreanus* had finished flowering. For a touch of yellow, some early and some late kniphofias would be good. One of the white crinums could be used for more weight in white.”

HYMENOCALLIS IN NORTH CAROLINA

ELIZABETH LAWRENCE, *North Carolina*

I have written before about the native white Spider Lilies (American Lilies), but I want to write again, for they are increasingly beautiful in my garden, and increasingly baffling. In North Carolina we have two that are native, a spring blooming one from the coast and a fall blooming one from the mountains. The spring blooming one I take to be *Hymenocallis mexicana* of the check list in *Herbertia* vol. 11, which Dr. Small calls *H. crassifolia*. Two years ago my brother brought me several bulbs in bloom from near Wilmington, N. C. where they grow in quantity in marshy places along the Cape Fear River. Last year there was no bloom, but this year they bloomed late in May. It seemed to me that they were the most beautiful of all, although there were not so many flowers to an umbel, as in the Louisiana species. They open at twilight, one to four flowers on twenty-four inch stalks. The leaves are as long as the stalks, and very narrow, to about an inch and a quarter across. The flowers are nine inches across, with a flat cup that is two and a half inches across, and a tube two and a quarter inches long. The segments are a quarter of an inch across. Apparently North Carolina is the northern limit for this species.

Our summer blooming species is *H. occidentalis* said to be native only as far east as Tennessee and Kentucky, but found just over the line in the North Carolina mountains. Last August I saw great drifts of this in bloom in Mr. Knight's garden in Biltmore, N. C. He said that he had collected it himself in North Carolina. In my garden it has been the only one that would bloom in shade.

In the Gulf states there are also spring and summer blooming species. The best known is *H. galvestonensis*, which has a bad name in cultivation. It bloomed for me a couple of years, but for the last two years the bud has blighted before it opened. I have two Spider Lilies similar to this. One came from Vicksburg, Mississippi, and one Mrs. Dorman got from Baton Rouge, Louisiana. These bloom regularly. They are not so large as our native (North Carolina) one. Still another

which Mrs. Dorman sent me, bloomed this May for the first time. It is the smallest of all, with four flowers on a seven inch scape, and this year it was the first to bloom, opening on the ninth of May. The plaited cup is an inch deep, and coarsely and characteristically toothed. The leaves are pale green like those of the *H. galvestonensis* type, but a little narrower (less than an inch across) and a little longer (to sixteen inches).

Another spring blooming species came from St. Martinville, Louisiana. It was listed as *H. occidentalis*. This is a very large one, with very broad foliage (two and a half inches across) like that of the tropical species, and of a bright dark green. The flowers are large, from nine to eleven on stout scapes over two feet tall. As many as six may be out at once, making it very showy, and especially lovely with *Iris gigantea caerulea*. The distinctly hexagonal cup is two inches and a quarter across, and the tube to three and a half inches long. This and the Wilmington Spider Lily are two of the handsomest amaryllids in the garden. They both like a heavy damp soil rich in humus, and must be planted in the open to bloom.

There is also a summer blooming Spider Lily in the Gulf states. This is similar to our *H. occidentalis*. It is not as reliable as to bloom as the spring species, but it is a very large and handsome one, with beautiful broad shining foliage. It has bloomed for me late in July, and early in August, but it seems difficult to establish. Mrs. Dorman sent me a number of bulbs over a period of several years, and I have tried them in all sorts of situations. One that seems to be established is in soil that is rich and damp, but well drained. It had two stout scapes last August with nine flowers to the umbel. The flowers were eight inches across, and the tubes over four inches long.

In the Alabama and Mississippi market bulletins you will find the farm women advertising the native white Spider Lilies for sale. This is the place to find these and other treasures.

AMARYLLIDS IN THE SOUTH

JO N. EVANS,

Haphazard Plantation, Ferriday, Louisiana

My earliest recollections—and I am a grandmother now—are of the Sunday afternoons and holidays that I tramped the woods and country roads with my Father in search of native flowers. This with my Mother's love of the old fashioned garden flowers is the background of my life time of searching for old, unusual native and naturalized plants.

Living for a number of years close to Natchez, Mississippi, has given me wonderful hunting grounds. In the early 1800's the people of Natchez built beautiful gardens. These gardens were generally laid out by landscape artists brought from Italy, France, and other foreign countries. These landscape artists brought much of their material with them. There are a number of records of old gardens still in existence, one such record tells of twenty-two miles of garden walks, bordered

with thousands of narcissi, another record tells of the terraces being planted with *Amaryllis*. I quote from an old book published in 1835,—“The broad walks were as usual in Southern gardens bordered by the varnished *Lauria Mundi*, occasionally relieved by the Cape Jasmine, slender althea and dark green arbor vitae. The splendidly attired *Amaryllis*, the purple magnolia, the Arabian and night-blooming jessamine, the verbinum or lemon scented geranium, with the mystic aloe that hoary monarch of the garden, which blooms but once in a century, the broad leaved yarra or coco and the sweet scented shrub and oleander with countless other shrubs and flowers, breathing forth the sweetest



Fig. 172a. Amaryllids at Haphazard Plantation—(Left) *Crinum scabrum*; (Right) *Amaryllis solandriiflora* hybrids naturalized.

fragrance gratified the senses and pleased the eye wherever it was turned.” (Joseph Holt Ingraham—*The Southwest*. New York. 1835.)

My first real interest in crinums came when I was searching for violets along a stream and came upon a clump of white crinums in bloom. I knew these were an escape, probably a small bulb cleaned out of some old yard and washed down stream by a hard rain, there in a deposit of sediment it had grown into a large clump. I later identified

this one as *Crinum bulbispermum album*. It is the first one to bloom with me. I grow it along the edge of a small lake and it always blooms with the Louisiana native iris. They make a pleasing combination.

I began to watch for these old lilies and have had many thrills finding different ones. I am not a botanist and can not identify all of the crinums that I have collected. I have one that blooms quite tall on stiff stems and holds its head very high, it is light pink with a shading to rose in the center of the petal, it is very hardy and blooms several times during the summer. The bulb looks like a large *Amaryllis* bulb.

Dr. Traub, editor of HERBERTIA, identified *C. scabrum* for me. (Fig. 172a). Every Southern garden should grow this crinum, with its beautiful cup shaped white blossoms banded through the center of each petal with dark red. It holds its head straight up. Miss Elizabeth Lawrence of Raleigh, N. C. has this to say about this crinum, "I agree with you *C. scabrum* is one of the best, but it is not hardy with me." This crinum is hardy in this part of Louisiana and every winter we have some weather that goes as low as 16 degrees. It blooms several times during the summer.

I have *Crinum giganteum* and each winter the top is frozen so badly that it never recovers enough to bloom for me. I have seen clumps of this crinum in bloom around New Iberia, Louisiana, and they are a spectacular flower to behold. Mrs. J. Willis Slaughter of Houston, Texas, who has grown and collected crinums for many years says "*C. giganteum* is the loveliest of them all, with its tulip-like white clusters that bloom from summer until frost in Houston, and meanwhile with its unique foliage is as decorative as an aspidistra when not in bloom." Houston is much warmer than my garden at Haphazard.

Another tender crinum that has not been identified grows around Lafayette and Abbeyville, Louisiana. This is about the warmest section of this state. This crinum has enormous bulbs, very long bright green leaves, and sends up a tall stem that has many dark red flowers with very narrow recurving petals. The bulb will not even stay with me during a real cold winter.

I have one good clear pink crinum that came to me from Lafayette and was originally obtained from an old garden in New Orleans. It seems to do its best blooming in October, as a cut flower it is as beautiful as *Brunsvigia rosea* (syn.—*Amaryllis belladonna* Ait.)

Of course I have *C. Powellii Alba*. I think this is one of the best of the pure whites and it never seems to be hurt by the winter weather.

Every old garden in this part of the country has the crinum that blooms in the summer and on through the fall. It was pictured on a well known catalogue cover as *C. fimbriatulum*. The petals are wide with a band of red and the flower opens up star shaped.

Around Baton Rouge there is an old crinum that is a nice light pink, when it blooms it points its petal straight to the sky. Mrs. Sarah Kelley, who is interested in crinums, has this to say "I think this crinum is a hybrid as it does not set seed to any pollen or when selfed". It is a quite unusual crinum.

Around most of the cabins on the plantation the old Milk and Wine Lily, *C. Sanderianum*, grows in large clumps. In this part of Louisiana where the Mississippi has occasionally broken the levees and covered the country, crinums have been one of the few plants to come through the water unharmed.

There is a very large white crinum in this part of the country that is very impressive. I have seen old clumps of this with as many as ten stalks in bloom at one time, standing at least four feet high, with ten to twelve blooms on each stalk. This is a very hardy crinum, I know of one winter that the temperature dropped to five degrees and it was not hurt. The bulbs are very large and seem to like shallow planting.

I bought *C. Kirkii* out in California, from a dealer, it is the same as one grown in our old gardens. Our native *C. americanum* takes well to cultivation and makes a nice garden plant.

I have bought all of the named varieties of crinums, or possibly I should say all of the named hybrids. In my opinion they are all worth while, *H. S. Elwes* is a beautiful light pink; *Cecil Houdyshel*, *J. C. Harvey* and *Virginia Lee* are all blooming in Haphazard garden. *Peachblow*, with its large rosy buds that open up into flowers with just a blush of peach-pink is a beautiful crinum. However, with me its stems are too weak to hold its heavy blossoms and unless staked it topples over. This may be a fault of too much fertilizer. *Ellen Bosanquet*, with its wine red blooms will always be one of my favorites. I grow it side by side with *C. scabrum* and often use it in arrangements together.

I find that the only difficulty I have with crinums is planting them too deeply. I give them lots of fertilizer and water.

If we could trace the history of these old bulbs there would be much romance revealed. No doubt they were brought to America for the fine old gardens of the South and from these gardens worked their way from hand to hand through the country. They are worth while for through several generations they have taken our floods and our long summers and are still sending forth their fragrant blossoms to every one who would enjoy them.

Along with my interest in crinums I became interested in *Amaryllis*. The old hybrid St. Joseph *Amaryllis* grows everywhere and in any kind of soil. Along with St. Joseph's *Amaryllis* we occasionally find a beautiful white *Amaryllis*. This one has a red stripe through the center of the petals and was identified for me by Mr. Cecil Houdyshel as *Amaryllis solandriflorum* hybrid (Fig. 172a). This *Amaryllis* should be grown a great deal more. It is perfect with a background of tall self blue bearded iris.

I am a little confused over the different types of *Amaryllis belladonna* Linn., non Ait. that I have found. There is no doubt that some types of this salmon pink amaryllis are much hardier than others. I have had them freeze in my garden at Haphazard, but two hundred miles farther north they were not hurt in the same cold weather. Some bloom on 24" stems while others are about 12" tall.

I have never seen *Agapanthus* bloom outdoors further north in the state than Baton Rouge. I keep hearing stories of old plantings of "Blue Lily of the Nile" but each time when I have investigated they have proven to be camassias.

I grow many of the big hybrid *Amaryllis* but have to be sure they are mulched when a real cold wave is headed my way.

I do not think I have covered the amaryllis as yet, but that is the joy of collecting there is always something just ahead, something to find, something to grow and something to learn about, and most important of all more beauty to enjoy.

[DAYLILIES—Continued from page 116.]

Camelot, Height 42". Evergreen foliage. Flower large, 6" standing; in color near saffron yellow (Pl. 10 J 8) with throat lemon yellow (Pl. 10 K 3) shading to golden yellow (Pl. 10 L 7). Petals ruffled, $4\frac{1}{2}" \times 1\frac{3}{4}"$; sepals $4\frac{3}{8}" \times 1\frac{1}{2}"$. Showy garden type.

Sun Queen, Height 30". Evergreen foliage. Deep chrome self-wide, frilly petals; narrow, twisting sepals. 6" flower. Petals $4" \times 1\frac{3}{4}"$; sepals $4" \times 1"$. Hint of green in throat. Early bloomer and recurrent.

Sunset Glow, Height 34". Evergreen foliage. Large round well shaped flower of good substance, $5\frac{1}{2}"$ standing. Petals $4\frac{1}{2}" \times 1\frac{1}{4}"$. In color samurai (Pl. 4 H 11), darkened and ruffled at edges with midzone capuline buff (Pl. 9 E 5). Sepals $4\frac{1}{2}" \times \frac{7}{8}"$, near pheasant (Pl. 4 C 11). Throat golden yellow (Pl. 10 C 7).

NOTE: Color references are to Paul and Maerz' "A Dictionary of Color."

5. THE AMERICAN PLANT LIFE SOCIETY

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REGISTRATION OF DAYLILY NAMES—Prof. J. B. S. Norton, *Registrar, 4922 40th Place, Hyattsville, Maryland*; and Mr. M. Frederick Stuntz, *Collaborator, 6505 Main Street, Williamsville, 21, N. Y.*

[Correspondence about priority of Daylily names should be sent directly to Prof. Norton, *but a self-addressed, stamped envelope should be enclosed if a reply is expected.*]

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[Reports from official trial gardens, indicated below, should be made directly to Prof. MacDaniels, by Aug. 1 in each year in order to be included in annual summary for HERBERTIA.]

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- | | |
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Note.—Introducers of new daylily clones should send plants directly to the Trial Gardens for testing. As soon as practical each trial garden will publish, in HERBERTIA, lists of the 10, 25, 50 and 100 best daylilies, on the basis of the clones tested, for the climatic region in which it is located.

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(d) DATA CARD FOR HEMEROCALLIS

When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and fully described in *HERBERTIA*, Vol. 7, 1940. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

These cards are available at present in the 3 inch by 5 inch size at the nominal price of \$1.25 per hundred, to pay for printing, handling and postage. Make checks payable to the AMERICAN PLANT LIFE SOCIETY, and send orders to—

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(e) SCORE CARDS FOR HYBRID AMARYLLIS AND HEMEROCALLIS

(a) *Hybrid Amaryllis*. For classification of flower types and score card for Hybrid Amaryllis see *HERBERTIA*, Volume 5, pages 141 to 145, 1938.

(b) *Hemerocallis Score Card*. For the official score card for Hemerocallis see *HERBERTIA*, Volume 7, page 126, 1940.

II. PUBLICATIONS OF THE AMERICAN PLANT LIFE SOCIETY

(a) PLANT LIFE, THE PERIODICAL DEVOTED TO PLANT LIFE IN GENERAL.

Vol. 1, (No. 1.) SYMPOSIUM ON NARCISSUS BREEDING by various authorities. (*Nos. 2 & 3.*) FIRST BROMELIACEAE EDITION. Profusely illustrated symposium on the bromels by Dr. Lyman B. Smith, Mulford B. and Racine Foster, David Barry, Jr., Ladislaus Cutak, and W. Hayward. 105 pages.

Vol. 2, (Nos. 1-3.) VERBENACEAE EDITION. Illustrated treatment of the Verbena Family by the Moldenkes, the outstanding authorities on this plant family. pages.

(b) HERBERTIA, THE YEAR BOOK DEVOTED TO THE AMARYLLIDS (AMARYLLIS FAMILY).

A complete file of HERBERTIA, the year book of Amaryllis Section of the American Plant Life Society, is indispensable to all who are interested in Amaryllids. A limited number of copies of the following are still available:—

Volume 1 (1934). DEDICATED TO HENRY NEHRLING. Containing the biography of Henry Nehrling, and many valuable articles on amaryllids; with a portrait of Henry Nehrling and 16 other illustrations; a total of 101 pages.

Volume 2 (1935). DEDICATED TO THEODORE L. MEAD. Containing the autobiography of Theodore L. Mead, and many excellent articles on varieties, breeding, propagation, and culture of amaryllids; with portraits of Theodore L. Mead and David Griffith and 18 other illustrations; a total of 151 pages.

Volume 3 (1936). DEDICATED TO ARTHINGTON WORSLEY. Containing the autobiography of Arlington Worsley, and important articles on description, genetics and breeding, physiology of reproduction, and amaryllid culture; with 3 portraits of Arlington Worsley, one color plate and 30 other illustrations; a total of 151 pages.

Volume 4 (1937). FIRST BRITISH EDITION. DEDICATED TO WILLIAM HERBERT. Containing the biography of William Herbert; the reprint of Herbert's essay, on Crosses and Hybrid Intermixtures in Vegetables; Dr. Darlington's essay, The Early Hybridizers and the Origins of Genetics, and many important articles on description; cytology, genetics and breeding; physiology of reproduction, and amaryllid culture; with two portraits, forty-four other plates and three figures; a total of 280 pages.

Volume 5 (1938). FIRST NETHERLANDS EDITION. DEDICATED TO ERNST H. KRELAGE. Containing the autobiography of Ernst H. Krelage; the history of amaryllid culture in Holland by Ernst H. Krelage, Dr. Uphof's important article in which the name *Hippeastrum* is rejected; a revision of the tribes of the Amaryllidaceae; and the species of Amaryllis; outstanding articles on forcing amaryllids by Dr. Grainger and Prof. Dr. van Slogteren; and many other articles on description, cytology,

ogy, genetics and breeding; physiology of reproduction, and amaryllid culture; with 33 plates and 2 figures; a total of 218 pages.

Volume 6 (1939). DEDICATED TO THE UNION OF SOUTH AFRICA, and containing articles on South African amaryllids, including the history of botanical exploration for amaryllids in South Africa, the distribution of South African amaryllids in relation to rainfall, and review of the genus *Agapanthus* by Frances M. Leighton; a review of the Genus *Cyrtanthus*, with many excellent line drawings, by Dr. R. A. Dyer; other articles—*Zephyranthes* of the West Indies by Dr. Hume; the Tribe *Gilliesieae* by Dr. Hutchinson; rating of daylilies for garden value by Mr. Kelso; daffodil articles by Jan de Graaff, and many other items on description, cytology, breeding, propagation, and amaryllid culture; with 44 plates and 10 figures; a total of 258 pages.

Volume 7 (1940). DEDICATED TO LATIN AMERICA, and featuring articles on Latin American amaryllids; biographies of Drs. Philippi and Holmberg; report by Dr. Goodspeed on the amaryllids collected by the Univ. of Calif., Second Andean Expedition; reports on the flowering of the "Blue Amaryllis," *A. procera*; and many other important articles on the description, propagation, breeding, culture, harvesting and storage of amaryllids. Of special interest are the important articles on the description, breeding and culture of daylilies by noted authorities. With 45 illustrations—30 plates and 15 figures—and a total of 242 pages.

Volume 8 (1941). FIRST DAYLILY EDITION. The first extensive symposium on the daylily, containing biographies of George Yeld, Amos Perry, Hans Sass, and Paul Cook, and important articles on daylily evaluation, breeding, propagation and culture. Also important articles on *Narcissus* and other amaryllids. Thirty-eight illustrations—27 plates and 11 figures—and a total of 185 pages.

Volume 9 (1942). FIRST ALSTROEMERID EDITION. Dedicated to Harry L. Stinson, the outstanding authority on this plant group, who contributes a summary of his work on Alstroemerid taxonomy, breeding, propagation and culture. This volume contains the autobiography of Prof. Dr. Abilio Fernandes, the Check-List of Amaryllids by Major Pam, and a review of the species of *Crinum* by Dr. Uphof, and also many important articles on daylilies, *Narcissus*, *Cyrtanthus*, hybrid *Amaryllis*, *Ixiolirion* and other amaryllids. Thirty-five illustrations—17 plates and 18 figures—and a total of 243 pages.

Volume 10 (1943). 10TH ANNIVERSARY EDITION. Dedicated to Elizabeth Lawrence, the outstanding authority on the use of amaryllids in the garden, who contributes a summary of her work in this field. This volume contains the review of *Agapanthus* and *Tulbaghia*, by Dr. Uphof; an article on *Brunsvigia rosea* and hybrids by Mr. Hannibal; a symposium on *Narcissus* breeding by Messrs. Powell, Reinelt, Berry, and Reynolds; a review of amaryllid chromosomes by Dr. Flory; articles on hybrid amaryllis, daylilies, and many other important articles on amaryllids. Forty-one illustrations—12 plates and 29 text figures—and a total of 205 pages.

Volume 11 (1944). FIRST ALLIEAE EDITION. Dedicated to Dr. Henry A. Jones, the eminent American authority on the onion. This is

one of the most outstanding issues up to the present for its record making contributions on the systematics of *Allium* by British authorities, and on onion breeding, propagation, and culture by American authorities. It contains Mr. Airy Shaw's translation of Vvedensky's *Alliums* of the Soviet Union; Stearn's essay on the onion in the Old World and other articles; and articles on onion breeding, propagation and culture by Dr. Jones and his colleagues. There are also important contributions on ornamental *Alliums* for North America, and *Allieae* of North America. There are excellent articles on hybrid *Amaryllis*, Daylilies and various other amaryllids. Forty-three illustrations—25 plates and 18 text figures—and a total of 369 pages.

Volume 12 (1945). FIRST EDUCATIONAL EDITION. Dedicated to Supt. R. C. Huey, a pioneer in the use of amaryllids as an educational tool. This volume contains a brief autobiography by Supt. Huey, and an article by him on the use of amaryllids in teaching plant science; the announcement by Mulford B. Foster of the reintroduction of the sweet-scented *Alstroemeria caryophyllaea*, and an article by Harry L. Stinson on the true *Alstroemeria Ligtu*. This issue also contains an article on the origin of *Tapeinanthus humilis* by A. & R. Fernandes; important articles on *Narcissus* breeding; *Leucocoryne* and related genera; articles on various other amaryllids, including valuable contributions on *Hemerocallis* description and appreciation, breeding, culture, and packing daylily plants for shipping. Twenty-four illustrations—15 plates and 10 text figures—a total of 180 pages.

Volume 13 (1946). FIRST NARCISSUS EDITION. Dedicated to Guy L. Wilson, the noted *Narcissus* breeder. This volume contains an autobiography of Mr. Wilson and an article on *Narcissus* breeding in Australia by Mr. Alston; articles by American *Narcissus* breeders, including Frank Reinelt, E. P. Powell, J. S. Cooley, C. W. Culpepper and W. R. Ballard; an article on the karyology of the subgenus *Ajax* of the genus *Narcissus* by the Fernandes's; a list of parents of hybrid *Narcissus* by Arno H. Bowers; *Narcissus* diseases by C. J. Gould; *Narcissus* insects and mites by E. P. Breakey; *Narcissus* culture by various authors. There are also articles on *Hemerocallis*, hybrid *Amaryllis*, *Habranthus*, *Crinums*, *Lapagerias*, *Agapanthus*, *Hymenocallis*, etc. Thirty-nine illustrations—186 pages.

The prices of available publications indicated below supercede all quotations made prior to 1947.

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[COOLEY, NARCISSUS—Continued from page 134.]

fragrant; flowers are of good substance relatively long lasting as cut flowers. Season; mid-April to Early May.

Emily. Leedsii type, 15 inches high; flower held horizontally, and are of delicate beauty; tepals white, cup light yellow in upper 1/3, changing to white gradually below. Named for Emily Dickinson. Early April.

Chieftain. Trumpet type, 21 inches high; self yellow, flowers held upright at an angle of nearly 90 degrees. Notable for tall scape and clear self color. Early April.

Janice. Trumpet type, 18 inches tall; yellow self; very slightly lighter yellow than Chieftain; flower held upright at an angle of nearly 90 degrees. Notable for vigor as a garden plant. Early April.

Spring. Barrii type; 15 inches tall; flower held horizontally; tepals white, cup yellow with reddish-orange rim. Early April.

The writer is particularly interested in the first one, *Canary Twins*, for it appears to have considerable merit. The flowers are somewhat like Pearly Queen but they are less pendant and the color is clear Canary yellow throughout. *Triandrus Albus* may be one of its parents in the group of seedlings from which it was selected.

The other four are also quite interesting and require further testing.

IN MEMORIAM — ERNEST BRAUNTON, 1867-1945

We regret to report the death of Ernest Braunton, long a highly esteemed member of the American Plant Life Society. He was born in London, England, August 21, 1867, the son of William and Emma (Haslett) Braunton, and moved to Rockford, Iowa, with his family in 1871 where he became an American citizen by naturalization as a minor. He moved to southern California in 1887 and was prominently identified with civic improvement throughout his long life. In his long and useful career he held many important positions.

He was supt. of landscaping at Singleton Court, one of the first elaborate estates in Los Angeles, in 1899, the grounds now occupied by the Los Angeles Orthopedic Hospital; supt. of the Leslie C. Brand estate, Glendale, 1902; planner of the Bryant Botanical Garden at Santa Ana; designer of the Lily Ponds at Huntington Library Gardens; and designer of the grounds for over 100 homes in southern California.

He was Professor of Landscape Gardening, University of Southern California, 1914-19; lecturer at the Farmers' Institute (University of California Extension) for several years in the early 1900's; and judge at many County Fairs, and Flower Shows throughout southern California, including all of the Pasadena Flower Shows from the first to the one shortly before his death in 1945.

He was Associate Editor, California Cultivator, 1901-1932; Editor, Garden Dept., Los Angeles Times, 1903-1926; Editor of "Garden Doctor Department," Los Angeles Times, 1942-45; contributor of articles to the Pacific Rural Press, Westways, and several eastern magazines; contributor of articles on southern California horticulture, to Bailey's Cyclopedia of Horticulture; and author of "Garden Beautiful in California."

He was a member of the Los Angeles Board of Forestry, 1911-1912; and member of the Los Angeles City Park Commission, 1916-1918.

Mr. Braunton died at the age of 77 years in Los Angeles, Calif., March 22, 1945, several days after he was judge at the Southern California Flower Show at Pasadena. He is survived by his widow, Mrs. Addie (M. Kirkpatrick) Braunton; two sons, Bertram A., of Glendale, Calif., and Stanley E., of Los Angeles, and three daughters, Mrs. Helen M. Rickabaugh, of Lakeport, Calif., and Mrs. Marion C. Millikan and Mrs. Ernestine E. Petersen, both of Los Angeles.

—*Hamilton P. Traub*

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HERBERTIA



1947

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The American Plant Life Society

Box 2398, Stanford, California

HERBERTIA

VOLUME 14

2ND DAYLILY EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, Stanford, California

1947

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PREFACE

With the appearance of this issue of *HERBERTIA*, our publication schedule is up to date. Although conditions in the publications field have eased up somewhat, they hardly can be considered as back to normal for paper—particularly coated paper such as is required for *Herbertia*—is still a scarce item, and the price is three times that of pre-war years, and the quality is still sub-normal. We are grateful to our readers who retained a sense of proportion and were patient and realized that under the circumstances the delay in publication was unavoidable, and that the winning of the war was more important than the regular receipt of a publication on plants.

It is now seven years since the appearance of the *FIRST DAYLILY EDITION* of *HERBERTIA* in 1940. Since that date, the interest in daylilies has not lessened. It is logical therefore that Volume 14 (1947) should be the *2ND DAYLILY EDITION*, and that it should be dedicated to an outstanding daylily breeder, the recipient of the 1947 *HERBERT MEDAL*, Mr. Ralph W. Wheeler, who has given us such fine daylily clones as *Ruby Supreme*, *Cellini*, etc. Mr. Wheeler favors us with a brief autobiography, and a valuable article on his plant breeding activities. We all congratulate Mr. Wheeler on his outstanding achievements.

Other articles on daylilies include reports from regional trial gardens by Prof. Watkins, Prof. Nelson and Mr. W. Quinn Buck; contributions on daylilies by Mrs. Gretchen Harshbarger, George Gilmer, Elizabeth Lawrence, Elmer A. Claar, Willie May Kell, Prof. Norton, Mr. Stuntz, J. Marion Shull, Mrs. Leonian, W. R. Ballard, Lewis A. Hurst, Dr. Cooley, Mr. Hayward, Mr. Culpepper, Mrs. MacArthur, and others.

In connection with the subject of daylilies, the reader should also re-read the daylily articles in the 1946 issue of *HERBERTIA*. These include two articles by Mr. Claar, an article on the Wheeler daylilies by Mr. Saxton, daylily culture by Mrs. Bright Taylor and Mr. George Gilmer. There are also the descriptions of many new daylilies under registration of clones.

The other amaryllids as usual are not neglected. Fred M. Danks writes on amaryllids in Australia, and Eric Hardy on amaryllids in the Holy Land; and W. F. Harrison on amaryllids in Mexico. Drs. Cox and MacMasters contribute an important article on starch in *Alstroemeria*; Dr. Uphof gives a review on *Pyrolirion*; "Ornatus" writes on double daffodils, with illustrations from photographs by Jan de Graaff; Stanley Johnson, Th. Hoog, Mr. Hayward and Dr. DuPuis contribute articles on hybrid *Amaryllis*; Mr. Hunt writes on *Alliums*; Mr. Hannibal on crinums; Dr. Cooley on *Sternbergia*; Mr. James on *Hymenocallis*; various amaryllids are discussed by Mr. Hayward, Mr. Vasku, and others.

Volume 15 (1948) will be the *2ND SOUTH AFRICAN EDITION*. It will include a review of the subject since the appearance of the *FIRST SOUTH AFRICAN EDITION* in 1939. Amaryllids in other parts of the World will not be neglected and the usual articles on *Hemerocallis*, *Narcissus*,

Alstroemeria, hybrid *Amaryllis*, etc., from the U. S. A. will be included. All are requested to send in their articles for this issue by April 1948 so that we may obtain early publication.

HAMILTON P. TRAUB

Beltsville, Maryland,
September 20, 1947.

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves*, *scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

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Dedicated to
RALPH WALDO WHEELER



Herbert Medalist—Ralph Waldo Wheeler

RALPH WALDO WHEELER

AN AUTOBIOGRAPHY

Pitcher is a small town in the Valley of the Otselic in central New York State. I was born not in this metropolis but out on the farm, November 28, 1880. By the time I was taking maple sugar in my pabulum it had been decided by my parents to move to the County Seat and so I was not to know the farm except as an idealized place for holidays and vacations, never as the exacting place for business life that a farm really is.

Among my activities as I grew up there was the usual gardening of those horse and buggy days, but under considerable protest on my part, each spring the planting of the pansy beds and violets, some study of botany with an herbarium which was required work in the State Normal School where I prepared for college; but there was no evident leaning towards either agriculture or horticulture. In fact, when I went to college it was to Amherst and not to one of the agricultural colleges.

After graduating from college in 1906 with the degree of Bachelor of Arts there were seven years of social and educational work, then twelve years in the wholesale millinery business, possibly somewhat of a step towards flowers. However, it was not until I came to Florida in 1925 that plants became a passion with me. My first years, in this land of flowers were fortunate in that my work required much traveling to all sections of the state. The tropical growth and strange, to me, plants at once captured my attention. It was natural therefore that I should assemble a collection of such natives and exotics as could be moved or propagated. In the meantime I had made the acquaintance of the late Henry Nehrling and the late Theodore L. Mead, two naturalists to whom all who come to Florida should be eternally grateful. Whatever further impetus towards horticulture was required, my association with these two grand men provided.

Already my attention had been directed to hybrid *Amaryllis* and so when the American Amaryllis Society (now American Plant Life Society) was formed in 1933, it seemed fitting to intensify my hybridizing efforts within this plant group. I had progressed to the point where my interest lay in the well open, full formed flower with short tube, short pedicel and flower face held in a plane above the verticle, now known as the Leopoldi type. As the basis of my further work I was fortunate in obtaining either bulbs or pollen of five distinct strains of Dutch and English hybrids, each with a long history of controlled greenhouse culture. At first the crosses were freely made, later with particular attention to color.

As was the common practice in Florida I was growing these bulbs in permanent plantings under half shade in a soil of an initial pH of 5½ which, by the addition of ground lime rock and oyster shell was brought up to just under pH 7 at time of planting. Some of the seedlings bloomed the second year, the balance in 30 months from the time the seed was planted. The resulting flowers were surprisingly fine, not so,

however, our natural out of doors growing conditions for these highly bred subjects of old world greenhouses. Some bulbs never bloomed the second time, others did bloom again but not with any degree of perfection, the bulbs losing their roots and becoming smaller and smaller each year. Even when lifted, cleaned, fumigated, cold treated, hormonized and replanted, vigorous new roots were not formed. Other Florida growers of the Dutch hybrids were having the same experience. Pot culture seemed to be indicated, but not being sufficiently equipped for this I reluctantly disposed of my collection of about 15,000 of these fine hybrids, retaining only those which had been given show awards, my named ones and those of which I had made Kodachrome slides. These I am attempting by means of pot culture in my greenhouse to bring back to health, a project I am not at all sure will succeed.

This just about brings us up to the main dish of the past twelve years, *Hemerocallis*, discussion of which, because of its length, it seems best to take up in a separate article.

NEW DAYLILIES FROM OLD

RALPH W. WHEELER, *Florida*

When, in the early days of the American Amaryllis Society, my neighbor, Wyndham Hayward, forced on me my first two daylilies he rubbed the lamp in just the right way to get a convert. Had anyone predicted that these two plants in part would found a race with the much sought for daylily characters he would not have been believed.

Only one of these plants made seeds from the first cross. From these seeds I grew fourteen seedlings, and as could well be expected the flowers were not too beautiful. However, one of them was quite different from any of the others, in that it had very wide segments for the small size of the flower. As little as I knew about *Hemerocallis* I did realize that this might be important, and since I wanted badly to see some virtue in these first daylily seedlings of mine I selected this one for further breeding, a choice more fortunate than could have been anticipated. This clone has turned out to be the best daylily parent I have tested in my experience with more than 200,000 seedlings. [Plate 302] Thus does the luck in plant breeding turn on a needle's point.

But luck alone is not sufficient; too much of it is bad. Also, the fact that we are not working for pure strains of seed but rather for superior clonal forms does not mean that Mendel's Law has no application here. True, some casual cross may produce an exceptional daylily, fine in every particular, but when working with large numbers of hybrids and with definite flower characters in mind it is essential to keep consistently going in the right direction. It is then that one needs to be sure that the laws of genetics are working for him rather than against him. Once this has become the established practice, any reasonable goal with daylily characters is possible. Patience, time and a fine knack in selection will bring closer and closer to perfection any particular plant character, flower form or color. When several of these improved

1947

Plate 302

Wheeler Seedling daylilies at the Irig Garden, Orlando, Florida



characters are assembled in one plant a better daylily has been produced.

We are all striving for pretty much the same things in this *Hemerocallis* breeding, the more obvious being plant vigor, more flowers to a stem, wider segments, a more open flower, beauty of form, larger flower size, sun resistance, better colors, new colors. Of these, color is the one usually uppermost in the mind of the average daylily enthusiast. Let us, therefore, examine a daylily petal. It is like a piece of velvet in having a back or body and a nap or pile. In only the yellows and the



Fig. 173. Hybrid Daylily—*Cellini*

clear oranges are both the body and the pile of the same color. Now it should be evident that no clear colors are possible unless both body and pile are the same. In the early reds the body color was orange and the pile only was red. These reds become dull quickly in the sun. My first red to show the same color well through to the petal back provided one of my real thrills in *Hemerocallis* breeding, for I then realized that it was going to be only a matter of time before we should have not only clear reds, but clear rose, then perhaps real pink and certainly purple, for already I had produced flowers with definite blue tones in the red, an indication that purple was on the way. In my own breeding for color

I feel greatly indebted to the fact that previously I had become familiar with color dominance in orchid breeding. I assumed this would hold in the same way with *Hemerocallis*. My results seem to justify this rather hasty assumption.

Hemerocallis flower description always has bothered me. I do not get even a hazy idea of the flower from a written description, and I doubt if the descriptions of my flowers are of any more benefit to those who read them. Particularly is this true with respect to the flower coloring. Therefore, last year I took more than 300 Kodachromes of my better



Fig. 174. Hybrid Daylily—*Haile Selassie*

flowers and newer colors. This year I shall take at least 200 more. These are the 35mm. stills, taken at a uniform distance from the flower, thus furnishing an accurate gage of relative flower sizes. Also, through these Kodachromes better than in any other way, *Hemerocallis* enthusiasts in widely scattered sections have been given previews of the color breaks and new flower types as they come along, instead of being shut off from all that's new, as by a wall, until the finished product, sufficiently propagated, has been released years hence. My slides have been freely circulated among those interested for both private viewing and public showings. The comments which have come back, like visitors to my garden, are as a tonic to the rebuilding of my own enthusiasm.

The varieties which I have named have been described in HERBERTIA beginning with the year 1940. In addition to the named varieties there is that small group of hybrids of very great interest to me because of color or character breaks. Many of these are of no value in themselves but they most certainly will influence future hybrids. The Kodachromes showing these "advance styles" are a much prized part of my slide collection.

As is inevitable, many of my introduced varieties have been surpassed and should be supplanted, as they are sure to be, though I shall continue to grow these for the record. Others later will be dropped as better hybrids come along and become available, while some are sure to be grown as garden and special collection plants for very many years. In the accompanying descriptive list of those varieties which I consider current there has been no attempt at competitive or numerical ratings, only time and large numbers of individual gardeners in different sections being able to do this with any finality. I have, however, indicated certain qualities and characters which should furnish a basis for rating in accordance with individual likes and dislikes. Needless to say I consider that they all have their points or they would not still be included.

WHEELER DAYLILY CLONES CONSIDERED CURRENT AS OF 1947

Amherst (1944); flower large, purple-white, yellow throat, tepalsegs wide; scapes 42" tall with up to 38 flowers; proliferations sometimes present. Chief distinction: color combination and form.

Angelus (1942) flower large, sulfur self, tepalsegs wide; scape 34" tall with up to 17 flowers; recurrent bloomer. Chief distinction: form.

Asia (1946) flower very large, gold yellow, iridescent dusting; yellow throat; tepalsegs medium wide; scape 30" tall with up to 30 flowers; proliferations sometimes present. Chief distinction: size and form.

Aurora (1946) flower medium size, rose to pink; yellow throat; tepalsegs medium; scape 36" tall with up to 17 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: coloring.

Ballet Girl (1944), flower medium size, crimson to pink; yellow throat; tepalsegs medium size; scape 32" tall with up to 44 flowers; recurrent bloomer. Chief distinction: coloring.

Billie Burke (1945) flower very large bicolor, purple maroon-yellow; yellow throat; tepalsegs wide; scape 36" tall with up to 19 flowers. Chief distinction: coloring.

Blackhawk (1941), flower medium size, deep chocolate maroon; gold throat; tepalsegs very wide; scape 32" tall with up to 18 flowers, recurrent bloomer. Chief distinction: color-form.

Bobolink (1943), flower of medium size, bicolor, purple-yellow; yellow throat; tepalsegs very wide; scape 45" tall with up to 37 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: coloring.

Brackel (1942), flower very large, wine mahogany in varying patterns; gold throat; tepalsegs wide; scape 32" tall with up to 67 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: coloring, often with spotted tepalsegs.

Cellini (1945) (Fig. 173), flower large, sulfur self; tepalsegs very wide; scape 38" tall with up to 27 flowers; recurrent bloomer. Chief distinction: beauty of flower form.

Cerise (1946), flower of medium size, cerise red, gold throat; tepalsegs wide; scape 36" tall with up to 40 flowers. Chief distinction: coloring.



Fig. 175. Hybrid Daylily—*Ruby Supreme*

Cornell (1946), flower of medium size, bicolor crimson-yellow, yellow throat; tepalsegs medium in size; scape 34" tall with up to 21 flowers. Chief distinction: coloring.

Demi-Tasse (1947), flower small, bicolor, magenta-orange, orange throat; tepalsegs narrow; scape 16" tall with up to 34 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: dwarf character.

Duncan (1941), flower large, deep red, gold throat; tepalsegs of medium size; scape 36" tall with up to 21 flowers; recurrent bloomer. Chief distinction: early blooming.

Easter Morn (1943), flower very large, deep yellow-dusted, yellow throat; tepalsegs very wide; scape 45" tall with up to 33 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: floriferousness and tepalseg coloring.

Empress (1942), flowers large, deep purple-maroon, gold throat; tepalsegs wide; scape 40" tall with up to 41 flowers. Chief distinction: coloring.

Ganymede (1943), flower large, bicolor, raspberry-yellow, yellow throat; tepalsegs very wide; scape 40" tall with up to 42 flowers; recurrent bloomer. Chief distinction: coloring and form.

Haile Selassie (1945) (Fig. 174), flower very large, purple-orange, orange throat, tepalsegs wide; scape 42" tall with up to 46 flowers. Chief distinction: coloring.

Halo (1941), flower very large, yellow-halo dusting, yellow throat; tepalsegs very wide; scape 54" tall with up to 43 flowers; recurrent bloomer. Chief distinction: form.

Hazel Sawyer (1945), flower large, laurel pink, yellow throat; tepalsegs of medium size; scape 38" tall with up to 45 flowers; recurrent bloomer. Chief distinction: coloring.

Indian Maid (1945), flower of medium size, very deep purple maroon, green throat; tepalsegs of medium size; scape 42" tall with up to 36 flowers; proliferations sometimes present. Chief distinction: deep coloring; orange halo surrounding green throat.

Luridum (1941), flower large, bright red, greenish throat; tepalsegs of medium size; scape 50" tall with up to 29 flowers; Chief distinction: coloring.

Madam Butterfly (1947), flower large, light orange with rust chocolate eye spots; orange throat; tepalsegs wide; scape 42" tall with up to 21 flowers; recurrent bloomer. Chief distinction: eye spots, color and form.

Martha Washington (1943), flowers small, antique ashes of roses, canary throat; tepalsegs very wide; scape 38" tall with up to 66 flowers. Chief distinction: coloring; flower form.

Ming Toy (To be described in 1948 HERBERTIA.)

Naranja (1946), flower large, deep orange self; tepalsegs wide; scape 36" tall with up to 25 flowers; recurrent bloomer. Chief distinction: beauty of form.

Ohred (1941), flower medium-large, crimson, canary throat; tepalsegs medium in size; scape 40" tall with up to 60 flowers; recurrent bloomer; proliferations sometimes present. Chief distinction: color; floriferousness.

Olympus (To be described in 1948 HERBERTIA.)

Paul Thrig (1942), flower medium-large, champagne, green-gold throat; tepalsegs wide; scape 40" with up to 21 flowers; recurrent bloomer. Chief distinction: pastel coloring.

Psyche (To be described in 1948 HERBERTIA.)

Robin Hood (1944), flower large, bicolor, carmine-yellow, green throat; tepalsegs of medium size; scape 36" tall with up to 32 flowers; proliferations sometimes present. Chief distinction: vivid red with green throat.



Fig. 176. Hybrid Daylily—*Victoria*

Royal Lady (1943), flower very large, bicolor, purple-yellow, canary throat; tepalsegs narrow; scape 50" tall with up to 45 flowers; recurrent bloomer. Chief distinction: form; coloring.

Ruby Supreme (1940) (Fig. 175), flower very large, ruby red, green-gold throat; tepalsegs wide; scape 42" tall with up to 47 flowers; recurrent bloomer. Chief distinction: color; flower size; many flowers.

Scarlet Sunset (1946), flower medium; brightest scarlet, orange throat; tepalsegs medium; scape 30" with up to 35 flowers. Chief distinction: brilliant color.

Tarrytown (1944), flower large, deep wine, yellow throat; tepalsegs medium; scape 48" tall with up to 37 flowers. Chief distinction: color.

Vega (To be described in 1948 HERBERTIA.)

Victoria (1944) (Fig. 176), flower very large, old rose-violet sheen; canary throat; tepalsegs wide; scape 48" tall with up to 48 flowers; recurrent bloomer. Chief distinction: beauty of form.

William Penn (1946), flower huge, purplish, red, chocolate, canary throat; tepalsegs wide; scape 36" tall with up to 17 flowers; proliferations sometimes present. Chief distinction: color; size of wide open flower.

AUSTRALIAN AMARYLLID NOTES

FRED M. DANKS

33 Balwyn Road, Canterbury E. 7,
Victoria, Australia

Beyond the daffodils, dealt with in *Herbertia* 1946, there is little we have to give to a Country so rich in natural species and cultivated hybrids, but a review of conditions here might leave a clearer impression of what we can achieve, and a listing of what we have done could indicate the future possibilities.

We have the climate to suit everything from Tropical Queensland to the sub-temperate Tasmanian areas—hill country and dry hot lands—and the garden-enthusiasm to try anything new.

Hemerocallis, which is the major interest of this 1947 issue of *Herbertia*, can quickly be disposed of so far as it concerns us, for beyond those raised from seeds that have come, we have nothing but the older clones. Our greatest lack is in the standards by which to value those we have, and beyond gifts we can get none of the latest shades to try since the dollars we have to spend must be used for the more necessary items. There is the strictest prohibition against imports, but the "Gift" parcels come through.

I had seeds from Dr. Leonian many years ago, and have pollinated the best plant selections of these each year to gain a fine array. Some of these I like, but have no idea as to how the colors compare with the latest. Black and white illustrations indicate the form but the only colors we have seen are those in the full page of the Wayside Gardens catalog.

We can however suggest that in prospect of a relaxing of the financial "tie-up", it might be worth an experiment to see just how small a portion of a plant can be taken to allow for air transport, and just at what stage it is best to send. First of all, we need to know what the blooms really are. A demand cannot be built up until our keenest growers see what has been achieved, and I cannot see any great interest in them until they are better known.

Among the *Brunsvigia* hybrids, including *Brunsvigia rosea* (Lamarck) Hannibal (Syn.—*Callicore rosea* Link; *Amaryllis belladonna* Aiton, non Linn.), we have a little to give. W. P. Aylett, an iris en-

thusiast, has many seedlings of the Cape Belladonna, *Brunsvigia rosea*, and D. Chandler did considerable work with them some years ago. Old Alister Clarke, a great personality in the rose world, has many; and Both, of "Tunia", Service Adelaide St. Aust., is raising thousands of hybrid *Amaryllis* Linn., (Syn.—*Hippeastrum* Herb.). His long experience with gladioli is sufficient to guarantee success.

Nerines too are popular, and again Alister Clarke has shown the same discrimination in selection as he has with his pink cup daffodils. Dave Chandler has some late blooming ones and I have some hybrids between the dwarf, *Nerine humilis* and the larger ones.

All here would welcome contact with growers and most have something good to send in return even if only seeds of our newest hybrids among the native *Leptospermums*—something quite apart from the older species—or the quaint Kangaroo Paws of Western Australia.

I myself can share my own papavers—already internationally recognized; freezias, *sparaxis*, tritonias, tigridias, callas, polyanthus (primroses), etc., and some complicated intercrossings of the California *Iris*. These last show great promise of becoming really useful garden plants.

Seeds would be the easiest to send, although our only restriction beyond a quarantine inspection is the financial one on live plants.

The following addresses are those of worth while "contacts": W. P. Aylett, "Mango" Nurseries, Mangoplah via Wagga, New South Wales; and D. Chandler, Tecoma, Victoria.

AMARYLLID STUDIES IN THE HOLY LAND, 1945 & 1946

ERIC HARDY, *England*

When the editor of *Herbertia* kindly asked me to contribute to the year book an article on any of the amaryllids I had come across in my plant-hunting journeys in Palestine and the Near East, I turned up my herbarium to specimens of *Pancratium*, *Vagaria*, *Narcissus* and other members of this group of beautiful flowers which recalled so many lovely scenes in a land where the sun and the flora are both generous to the field naturalist. I propose here to deal mainly with members of *Pancratium*, *Vagaria*, *Sternbergia* and *Narcissus* which enhance the Levantine flora.

Most of these are flowers of the spring or the autumn. In the late summer (July-August) of 1945 my friends and I made a fortnight's survey of the Anti-Lebanon area of the North Levant, and part of the Lebanon, and although we collected 285 species of plants and 11 subspecies, comprising 202 genera of 69 families, there were only *Allium* species to represent the Amaryllidaceae at that season of the year. Among these *Allium paniculatum* L. and *A. ampeloprasum*, and one or two other species were especially notable. In February 1946, I led an eight-day expedition to the south end of the Dead Sea, and the Wadi el Araba desert lying between there and the Red Sea, during which I collected 145 plant species of 44 families, of which 15 species were mono-

cotyledons, yet none of these was an amaryllid. Most of my specimens came from the central limestone hills of Palestine and the Mediterranean coastal plain.

The polyanthus narcissus, *Narcissus Tazetta* L. is very abundant in the spring on the hills, on Mount Carmel, the forest at Bab el Wad beside the Jaffa to Jerusalem road, in the Galilee and Huleh areas, and elsewhere. This is undoubtedly the most likely origin of the Biblical "Rose of Sharon" despite the fact that gardeners cultivate under the latter name several plants which are not native to the Holy Land. The Hebrew word is *Chabatze' elath* which, like the Septuagint and the Greek origins, denotes a bulbous plant and therefore rules out any true rose—anemone or ranunculus. The "Rose of Sharon" of Canticles ii, 1, is translated "flower of the plain" in the Septuagint. The English Authorized and Revised versions of the Bible suggest the autumn crocus for Isaiah xxxv, 1, by which I presume they meant the common meadow-saffron (*Colchicum*). Others have suggested that Solomon imported and cultivated a true rose. My contention is supported by the late Prof. W. E. Post, of the American University of Beirut, in his *Flora of Syria, Palestine and Sinai*. I have seen the polyanthus narcissus so abundant on the Plain of Sharon that there is no doubt that it was equally abundant in Biblical times to impress the historians. Even today Arab boys gather armfuls of it in spring and stand by the roadside hawking them to passing motorists.

I found this narcissus in full flower as early as the first week of December 1945 in the shelter of the open pine forest at Bab el Wad ("The Gate to the Pass", or "Valley") following the arrival of the winter rains, and it lasts into the first month or two of the new year, till March. In the New Year it was an abundant flower of the countryside from Gaza up to the Lebanon hills. It bore three or four orange and white flowers on each stem and was strongly scented. One of the Targums or early Aramic paraphrases of the Old Testament explains the original Hebrew word by narcissus. I found it in fruit at the end of March. The flower stalk was about 6 inches high and the flower when fully opened not more than an inch in diameter. The only other *Narcissus* I collected was probably the late-flowering *Narcissus serotinus* L. (which grows in the dry hills of Hadera on the coast at Tripoli in Syria) from near Rehovoth, on the coastal plain, in October 1945. It had a larger, single flower and I had it identified tentatively at the Hebrew University herbarium in Jerusalem. Instead of a yellow corona dominating the center of the flower, there were prominent yellow anthers. The petals were white and six in number, and the leaves appeared after the single flower. It was most probably an escape from cultivation. *Narcissus Tazetta* L. in the Levant has three sub-species, namely *typicus* Boiss., the common form, *syriacus* (Boiss. et Baill.) Boiss., of North Palestine, and *cypri* (Haw) Boiss., of Aleppo, Syria.

Next we turn to those lovely ornaments of the western hothouse, but here delicate treasures of the hills and the sands, *Pancratium* and *Vagaria*. I made a special study of these with my colleague W. F. W. Harding, and we have already published jointly several of these ob-

servations (Jour. Roy. Hort. Soc., London, Vol. LXXI. pt. 3, March 1946). They belong to the drought-resisting bulbous flowers which come into bloom without any assistance of moisture as they flower before the great drought breaks. One species of *Pancratium* is quite common and another is not. The one species of *Vagaria* is also fairly common. The first one that we found was the so-called "Sea-Lily", *Pancratium maritimum* L. which we collected from sea-side dunes in pure sand at Gaza, near Jaffa, etc., in September and October. It also grew at Nathanya and was no doubt abundant all along the dunes before their development. It was also called the Sand-Lily and the Sea-Pancratium. Harding found it in full flower at Gaza facing the sea in the second week of September. On August 18, I found the plants south of Jaffa, at the Wadi Rubin estuary, in bud. Their leaves were a prominent feature in May. This Sea-Lily was usually in the pure sand but I have also found it in the sun-dried mud which joins the sand at the Wadi Rubin estuary. A flower of great beauty, it bore an umbel of 3 to 10 blooms at the top of the foot high scape, reminding one superficially of the mixture of a large white trumpet daffodil and a Madonna Lily. The resemblance is very close to the daffodil and the perfume is most pleasing. Long after the flower had faded, one single bloom would scent the whole of our room with honey sweetness. The flowers are pollinated by night-flying moths, probably the hawk moths (Sphingidae) which I saw commonly near them. When ripening, the base of the flower elongated considerably, and the carpels of the seed-head swelled with their 6 to 12 black satiny seeds.

On September 16, we found *Vagaria parviflora* Herb., which is called the "Small-Flowered Pancratium", upon a rocky limestone slope in thin soil on the open edge of the Government pine forest (*Pinus halepensis*) at Bab el Wad, beside the Jaffa-Jerusalem road beyond Latrun, at about 900 feet. Subsequently, it was found to be fairly widespread amongst the stony hills of this dry woodland. Poor rock crevices on dry hillsides are its favorite haunt at Mount Carmel and it grows likewise near Beirut and Sidon in the North. When we dug down to examine its bulbs we found them clinging hard to the face of the rock and thrusting their thick contractile roots tenaciously into the cracks. The bulb was the same size as a rather large daffodil bulb measuring 3 by 2 inches, but covered by thin outer scales of a most distinctive satiny, blackish-brown color which give it a characteristic appearance. They were growing in crevices of the rock 9 inches below the surface and they usually broke away at the root-plate at the base of the bulb when gathered. The flower scape was about as tall as that of *Pancratium maritimum*, that is a foot high, but more slender and bearing flowers of only about one-third the size. There was a disappointing lack of scent with this species, and I assume it is not pollinated by night moths. The flower heads when found in bud were like white liliun buds, with green stripes; they burst open immediately they were touched. In October the plants were in seed, with globular dark green swellings at the seed heads; in fruit they were not a little unlike the appearance of the fruiting heads of isises.

The third species, *Pancratium Sickenbergeri*, grew in the more desert regions around the Dead Sea and was characterized by its leaves which curled up into a distinct spiral at the tip. It flowered in October in the desert near Sebbeh.

Interesting structural features set apart *Pancratium maritimum* and *Vagaría parviflora*. The main differences between these species lie in the coronas, the former having larger flowers, 4 or 5 inches in length, and a corona resembling that of the trumpet daffodil except that it is bordered by 12 large triangular teeth. From the angle of each alternate indentation and opposite to the midrib of the perigonium (which consists of 3 petals and 3 sepals of similar appearance) a stamen arises. The non-free portions of the filaments of the stamens can be discerned as thickened veins in the corona which ultimately merge with the central veins of the perigonium segments, the remainder of the corona at the same level merging with the tube of the perigonium. Apart from the smaller size of the flower in *Vagaría parviflora* which is only about a third the size of that in *P. maritimum*, every alternate indentation of the corona is carried down almost to the junction of the perigonium with the corona so that the corona is almost completely split into six portions each of which has the non-free portion of the filaments of a stamen serving as its midrib. Thus we see stamens arising from the perigonium, the filaments of which have for half their length a winged blade on each.

This would seem to be a transition stage between the structure of *Pancratium maritimum* and a corona-less flower with simple, straightforward stamens. On this basis we might consider the corona as an elaboration of the stamens. Baillon, however, in his work on coronas in general, regards them as disc-like developments of the floral axis comparable with the nectar-secreting discs which are frequent in flowers.

The seeds of *Pancratium maritimum* and *Vagaría parviflora* resemble glossy black beech seeds with their three sides, and it was interesting that when our Jewish guide at one of the hill settlements one day offered us a gift of seeds of the "Rose of Sharon", he eventually produced these seeds. This flower of course is not given that name.

Finally, the lovely showy sternbergias, which seem to have suffered most at the hands of the collectors, are today much rarer in Palestine than when most of the older books on its flora were written. The yellow, funnel-flowered *Sternbergia lutea* was rare near Jerusalem excepting at one spot near the neighboring Jewish village of Beit Hakerem where it flowered in the early autumn, but at that time it is very abundant in great masses over the Transjordan countryside south of Amman. The place where I found it most abundant in Palestine was on the hillside overlooking the railway gorge at Dier es Sheikh in the hills some miles below Jerusalem. That was in February when its leaves had come up in abundance, a sign of what must have been a very striking show of flowers in the previous autumn. Writing in the 17th Bulletin of our wartime Jerusalem Naturalists' Club, my friend F. H. Norris noted collecting *Sternbergia ? Fischeriana* bulbs in the limestone just below the summit at 5,500 ft. on Mount Cassius, on the Syrian-Turkish border,

in May 1945. There, judging by the number of seed-heads, it was not very free-flowering in the wild state. It was rather more stunted at this height than lower down. The bulbs proved quite hardy in southern England where one flowered. He also found *Vagaria parviflora* in seed near the falls at Baniyas, in the upper Jordan Valley on December 1st (Bull. 27, J. N. S.). *Sternbergia pulchella* is supposed to grow in the Lower Lebanon; *S. Clusiana*, the dwarf one, is also widespread outside the Jordan Valley.

The other amaryllid is *Ixiolirion montana*, growing locally in spring, between Gaza and the Lebanons. Erect blue-violet flowers mark its growth in the hills and fields, with its narrow, glaucous leaves.

[Editorial note.—Photo prints of *Pancratium maritimum* and *Vagaria parviflora* by Capt. W. F. W. Harding of the British Army, and also his brief notes about these two species, were received too late for inclusion in this issue of *Herbertia*, and will be reproduced in the 1948 issue.—H. P. T.]

GROWING AMARYLLIDS IN MEXICO

W. F. HARRISON, *Mexico*

Since Mexico is a mountainous country and extends from north of the Tropic of Cancer to well down in the direction of the Equator, and on the east from the hot tropical Gulf of Mexico to the warm Pacific Ocean on the west, one finds every degree of climate, hot, cold, wet and dry—the tropical fever ridden coast of Yucatan and Vera Cruz to the high Sierra Madre around the Mexican Central Plateau, where it freezes and snow falls, as it does in the Northern United States, reaching from the dry desert states of Sonora and Coahuila to the heavy rainfall on the Isthmus of Tehuantepec. The native vegetation varies with the climatic conditions. In the dry parts or where it is dry for several months in the year, a large percentage of the plants are bulbous or rhizomatous. These include many amaryllids. In the mild temperate mountain valleys of Vera Cruz, where it never freezes and never gets really hot, one finds many species of *Hymenocallis* or Spider Lilies, and other tuberous or bulbous plants growing in cans, pots, or any container that will hold a little soil, or planted directly in the open ground, crowded between other plants and trees. Every home has its plants—some have been handed down from one generation to another, others brought from distant places. In the moist warm mountain valleys they have found a congenial home—some have names, many have not; some are used in medicine, others for their beautiful flowers. The women especially are fond of flowers. Hunting around in these old towns, one may find many plant treasures.

The hybrid *Amaryllis* seem to be practically unknown to the natives, and what few are here have been brought in by foreigners in the last few years. When I was forced by poor health and malaria to move from the valley close to El Inante and the National Highway to a higher altitude, I decided to try raising hybrid *Amaryllis* along with other flowers and

fruits for I have always had a soft spot in my heart for these huge and beautiful flowers. The moist temperate mountain climate, at an elevation of about 3500 feet, seemed to be adapted to their culture. It seldom frosts, except in rare years, when it does even freeze the sugarcane in the valley below. The heavy rainfall is from May to October, but there is usually some rain in every month of the year.

I found several species of *Zephyranthes*, or Fairy Lilies, growing in humus amongst the rocks, and under the shade of the big oaks and sweet gums. The soil is very fertile because the forest is heavy and the ground is carpeted with a thick mulch of leaves and humus. However, there are only patches that can be cultivated for the rocks and boulders are so liberally scattered between rocky hills and canyons.

Here, hybrid *Amaryllis* planted in the open ground begin to bloom from the middle of February, depending on how cold the winter was. Some do not lose their leaves unless frozen, others go dormant naturally in December. The first seeds are usually ripe by the end of April. I do not allow plants to produce seeds unless I wish to plant them for it is a strain on the vitality of the bulb. As soon as the pod splits open, the seeds are planted in moist soil—half loamy sand and half decayed humus. The flats are placed so that the seeds get heat but not the open sun. By the middle of September, or before the weather gets too cold, the seedlings are transplanted to other flats or pots so that they will make abundant roots before cold weather sets in. Here they are left all winter until they are transplanted to the open ground about the first of March—in ground that was heavily fertilized with barnyard manure in the previous year. The plants are hoed or cultivated to keep the weeds down. The young plants are planted about one inch deep, or plenty of loose soil is placed over the bulb to keep it from drying out in the hot spring sun. A light dressing of bone meal, and plenty of moisture are provided for these bulbs seem to enjoy a cool, damp soil. After the plants are well established, and before the rains set in during May, they are given a good mulch of leaves and manure. This serves to keep the soil from washing, and provides additional nutrients when the soluble compounds are carried down to the roots by the rain water.

In our usual dry spell in August, the mulch is lightly hoed in, but care is taken not to injure the roots that are close to the surface. In the case of a big bulb the roots may extend for two feet in all directions. A new mulch is then given that will remain on the ground until it is hoed in during January or February. I have had plants that produced eight flowers to the stalk, and two 34-inch stalks to the bulb. These are however not the most delicate colors.

At various intervals the bulbs are given a dressing of bone meal, and the soil around them is lightly hoed, until May when they are given another mulch of humus and manure which is left until August. The mulch is then hoed in and another mulch put on because sometimes in August and September, we have hurricanes, when the bottom falls out and it really rains. I try therefore to protect my soil for it is easier to keep it from washing than to make new fertile soil. Even a few grass clumps and weeds are better than nothing for they can easily be hoed up after the rains are over.

By the spring of the second year, some of the strongest will put up a flower stalk. Out of seventy seedlings of a pure red *Amaryllis* pollinated from a rose pink, I had one bloom in twenty-three months, four good, big flowers on a twenty inch stalk, of nearly the same color as the seed parent. Red was therefore dominant over pink. Four others bloomed by two years, but only one was outstanding. Since they are planted fifteen inches apart and the rows are two feet between rows, they will be left in place until the fall after they have all bloomed. Then they will be sorted according to quality marked on the labels, and the offsets from superior bulbs will be planted separately.

The hybrid *Amaryllis* is one of the most beautiful and at the same time one of the most easily cultivated and fool proof bulbs. If one gives them only reasonably good care, one will be richly rewarded. Usually they are quite free from diseases and insects. In this locality, in some years, a white and black ringed hairy caterpillar will get on them and devour many leaves unless removed. They are however easily killed by knocking off into a pail containing some oil on water. In the spring, when the buds grow up, the climbing green cut-worm will sometimes eat into the tender buds. But with a little vigilance these are easily controlled. A few plants have died from internal dry-rot—the leaves turn reddish-brown and dry up; on examination of the bulb, it will be noted that the heart has dried up although there is no sign of decay, and the roots remain in good condition. Fortunately the disease does not seem to be contagious for plants close by are not affected. Young plants should have some protection from the midday sun for the tips of the leaves will burn in the full sun. With full sun, on delicate plants, all leaves dry up and will not be replaced until the cool weather comes again.

IN MEMORIAM—LEON HATCHIG LEONIAN, 1888-1945.

[PLATE 303]

The flower fanciers, who knew of his work in the development of the day lily, regret the passing of Dr. L. H. Leonian at his home in Morgantown, West Virginia on June 7, 1945. He was especially noted for the improvement he made in color quality of *Hemerocallis* of the fulvous types.

Dr. Leonian was born in Van, Armenia, February 27, 1888, and received his secondary education there. He emigrated to the United States in 1910, where he worked for a few years in New York and Detroit. He graduated from the University of Kentucky with the B. S. degree in 1916 and from the University of Michigan with the degree of M. S. in 1917. Following a year as Assistant Research Horticulturist at

[LEONIAN—Continued on page 32.]



Leon Hinchig Leonian, 1888-1945

1. REGIONAL ACTIVITY AND EXHIBITIONS

REPORT ON DAYLILIES, 1947

ELMER A. CLAAR, *Chairman,*
Hemerocallis Committee,
American Plant Life Society

Dr. Leonian and Mr. Betscher have passed away; Mr. Traub has been away and has not as yet resumed hybridizing; Mr. Plouf had been away to the war and had no new seedlings last year; and Mrs. Nesmith had to curtail her activities due to wartime pressure. Therefore, I did not make my annual trip East this year, partly because of these facts and partly because of the stress of business and lack of time.

However, I had, before the season opened, about 500 named varieties of daylilies and added about 75 new ones this year, and I have had access to the University of Chicago plantings of over 1000 named varieties, so that the season has not been without its thrills.

I was appointed Chief Hemerocalliarian of the Men's Garden Clubs of America this year, and each of the local clubs immediately proceeded to appoint a head hemerocalliarian. I started to canvass these individuals to see what they were growing and to give what encouragement I could to improve their plantings. This entailed a lot of correspondence and resulted in some warm friendships. You will find below a list of the head hemerocalliarrians of 49 of the local Men's Garden Clubs of America, and I would suggest that if you have a problem and you live near one of them that you get in touch with him.

The year has been eventful in that daylilies have been added to most of the iris catalogs.

During the year I have written several articles to boost daylilies; one for the Flower Grower, September, 1947; one for Plants and Gardens, the Brooklyn Botanic Record, Summer, 1947; one for the Home Garden, May, 1947; and one for the New York Times, April 27, 1947.

In addition, I entered a daylily exhibit at the Highland Park Garden Show, which was co-sponsored by the Ravinia Garden Club, and the exhibit won a special award and first prize.

During the year I received reports of the plantings from the Trial Gardens of the American Plant Life Society and am attempting to follow them through.

The Midwest Hemerocallis Society held a rousing meeting this summer, in which many people interested in daylilies took part. This is a very enthusiastic group and there is no doubt but that they will accomplish a great deal in furthering the popularity of our favorite plant.

I took a trip to Jamaica this year and while there called upon the head of the Agriculture Department. He had never seen or heard of a daylily.

I came back by way of Florida but it was early in the season so I did not attempt to look up Mr. Wheeler, Mr. Hayward, or any others of the enthusiastic group around Winter Park or Miami.

The American Iris Society met in Evanston on June 7 and one of the points of call was my garden, not so much for the iris as to see the collection of daylilies. Those that were pre-eminent at the time were *Flavina*, *Earliana*, *Brunette* and *Little Cherub*. These people were also enthusiastic about my tree peonies and herbaceous hybrid peonies.

HEMEROCALLIS TESTING PROGRAM

MEN'S GARDEN CLUBS OF AMERICA—1947

CHIEF HEMEROCALLIARIAN—Elmer A. Claar, 1400 Lake Shore Drive, Chicago, Ill.

HEAD HEMEROCALLIARIANS:

Men's Garden Club of Akron (Ohio); O. L. Schneyer, R. D. 7, Box 163, Akron 3, Ohio.

The Men's Garden Club of Albany (New York); J. L. Perlman, 41 Ryckman Avenue, Albany 3, New York.

Men's Garden Club of Asheville (North Carolina); L. B. Ordway, 221 Westover Drive, Asheville, N. C.

Men's Garden Club of Atlanta (Georgia); Milton W. Blanton, 1442 Copeland Avenue, S. W., Atlanta, Georgia.

Auburn Men's Garden Club (Alabama); Dr. John R. Moore, P. O. Box 82, Auburn, Alabama.

The Men's Garden Club of Broome County (N. Y.); Tracy E. Darrow, 113 Leroy Street, Binghamton, New York.

Men's Garden Club of Champaign County (Ill.); J. T. Ledrum, 1014 W. Charles St., Champaign, Illinois.

Men's Garden Club of Chicago Region, Inc. (Ill.); James W. Coffey, Rm. 312, 228 N. LaSalle Street, Chicago, Illinois.

Men's Garden Club of Cleveland (Ohio); Allen H. Frost, 3893 Silsby Road, University Heights 18, Ohio.

Men's Garden Club of Corvallis (Oregon); Lee A. Powell, Route 1, Box 671, Corvallis, Oregon.

Tri-City Men's Rose & Garden Club (Davenport, Iowa & Rock Island & Moline, Illinois); Rev. Edwin C. Munson, 615 Forty-Fifth Street, Rock Island, Illinois.

Men's Garden Club of Denver (Colorado); LeMoine Bechtold, 1639 Pearl Street, Denver, Colorado.

Men's Garden Club of Des Moines (Iowa); Ralph Deitrick, 1315 25th Street, Des Moines 11, Iowa.

Men's Garden Club of Regional Detroit (Mich.); Henry J. Beyerle, 7691 Penrod Avenue, Detroit, Michigan.

Men's Garden Club of Elmhurst (Illinois); V. D. Comp, 555 Berkeley Avenue, Elmhurst, Illinois.

Men's Garden Club of Snohomish County (Everett, Washington); Ed Manning, Route 1, Hartford, Washington.

Men's Garden Club of Fort Wayne (Indiana); C. T. Toothill, 3016 Webster Street, Fort Wayne, Indiana.

Men's Garden Club of Freeport (Illinois); J. A. Riner, 105 N. Harlem Avenue, Freeport, Illinois.

Grant's Pass Men's Garden Club (Oregon); Wilford C. Allen, 911 Washington Boulevard, Grant's Pass, Oregon.

Men's Garden Club of Great Neck (New York); Ralph Bailey, 17 Bellingham Lane, Great Neck, New York.

Men's Garden Club of Highland Park (Illinois); William Riddle, 1444 Marion Avenue West, Highland Park, Illinois.

Men's Garden Club of Hinsdale (Illinois); Hubert A. Fischer, Meadow Gardens, Route 2, 63rd Street, Hinsdale, Illinois.

Men's Garden Club of Houston (Texas); Pat E. Welch, 3809 Gertin Street, Houston 3, Texas.

The Horticultural Society of Jackson (Michigan); John Dorfmeister, 608 S. Grinnell Street, Jackson, Michigan.

Men's Garden Club of Jackson (Mississippi); T. G. Morel, 723 Wingfield Street, Jackson, Miss.

Men's Garden Club of Jacksonville (Florida); J. R. Waters, 1429 Edgewood Avenue, Jacksonville, Florida.

Men's Garden Club of Knoxville (Tennessee); J. R. Holcombe, Woodburn Drive, Knoxville, Tennessee.

Men's Garden Club of Lancaster (Penna.); Menno Swarr, 28 Parkside Avenue, Lancaster, Penna.

Memphis Men's Garden Club (Tennessee); John E. Pierce, 2583 Jackson Avenue, Memphis, Tennessee.

Men's Garden Club of Minneapolis (Minnesota); F. A. Upsher Smith, 2002 Iglehart Street, St. Paul 4, Minnesota.

New Trier Men's Garden Club (Illinois); Elmer A. Claar, 1400 Lake Shore Drive, Chicago, Illinois.

Men's Garden Club of New York (New York); Ralph Bailey, 17 Bellingham Lane, Great Neck, New York.

Oakland Business Men's Garden Club (California); Jas. H. Cobbledick, Sr., 1774 Woodhaven, Oakland 11, California.

Men's Pioneer Garden Club (Pine Bluff, Arkansas); George Gandy, 1200 E. 8th Street, Pine Bluff, Arkansas.

Men's Garden Club of Pittsburgh (Penna.); Louis Steiner, 2309 Birtley Avenue, Pittsburgh 26, Penna.

Men's Garden Club of Portland (Oregon); Art Steele, 217 Russett, Portland, Oregon.

Men's Garden Club of St. Louis (Missouri); Wm. C. Sisco, 6032 Clemens Avenue, St. Louis 12, Missouri.

Men's Garden Club of St. Paul (Minnesota); N. P. Collis, 1544 Edgecumbe Road, St. Paul 5, Minnesota.

Men's Garden Club of Salem (Oregon); E. D. Burres, 230 S. 21st Street, Salem, Oregon.

Men's Garden Club of Savannah (Georgia); S. C. Forbes, 525 E. 55th Street, Savannah, Georgia.

Men's Garden Club of Syracuse (New York); Victor J. Adamy, R. D., Fabius, New York.

Men's Garden Club of Toledo (Ohio); Wm. F. Bremer, 910 Secor Road, Toledo, Ohio.

Walla Walla Men's Garden Club (Washington); Dr. Philip H. Pope, 925 Alvarado Terrace, Walla Walla, Washington.

Men's Garden Club of Watertown (New York); Ronald Fields, R. D. 3, Watertown, New York.

Men's Garden Club of Waukegan (Illinois); Robert Murdock, Zion, Illinois.

Men's Garden Club of Webster Groves (Missouri); Charles M. Warden, 327 Greeley Avenue, Webster Groves, Missouri.

Men's Garden Club of Westfield (New Jersey); D. J. C. Drew, 771 Boulevard, Westfield, New Jersey.

The Steel City Garden Club (Youngstown, Ohio); Homer E. Casgrain, 37 Court Street, Canfield, Ohio.

THE MIDWEST HEMEROCALLIS SOCIETY

MRS. GRETCHEN HARSHBARGER, *President*

The Midwest Hemerocallis Society, a year old and 650 members strong, celebrated its first birthday with a Flower Show at Shenandoah, Iowa, July 19-20, 1947. Approximately 5,000 enthusiastic gardeners from 17 states, including Texas, Montana, and New York, visited the nursery town for the occasion, armed with exhibits, notebooks and pencils, kodachrome slides and movies. Hotels and private homes being overbrimming, a dormitory was set up in the basement of one of the churches.

The show was extremely informal with no set rules for judging since the goal was to educate and enthuse. Everywhere was the light-hearted atmosphere of a family reunion, the only complaint being that one had a hard time seeing all the show because one kept meeting such interesting people! The flexible program included many demonstrations which went on with the gusto of a three-ring circus. The corsage-maker emphasized how to use hemerocallis in corsage work; the pottery wheel turned out vases for arrangements; and the arrangers took cut stalks of hemerocallis and blended them into artistic masterpieces before your eyes.

Two hundred forty-five people brought exhibits which were unusually well labeled. Since hemerocallis enthusiasts are also interested in other flowers, and since the Round Robin letter groups and American Penstemon Society were participating guests, there was a profusion of every sort of flower including exhibits of phlox, lilies, wild flowers, penstemons, plantain-lilies (20 varieties), shrubs, coleus, Rex Begonias, and plants with variegated foliage.

Flower kodachromes and movies were shown almost continuously in the "Eskimo Theater" which had been improvised from a basement nursery storeroom. There one could sit and enjoy beauty while resting

ones feet! One visitor wrote "I think I actually spent 6 hours at the 'theater' and I did not see one picture the second time and I didn't see all of the pictures." Among those shown were some from Sam Caldwell (Geddes Douglas seedlings), J. Marion Shull, M. Frederick Stuntz, Darrell Crawford, Vivian Christenson, Ben Darby, Mrs. Helen Fischer, and H. M. Russell.

Though the amateur exhibits were excellent, including many named varieties and some promising seedlings, it was around the growers tables that interest was most keen. Owing to the difficulty of transporting open blooms, and the even more touchy task of trying to bring blossoms that would open the following day, only growers within driving distance attempted displays. Mr. H. A. Zager of Des Moines brought arm loads of carefully labeled stalks of varieties in commerce. Most of these had been selected so that they would have open blossoms both days.

Hans Sass and Henry Sass showed a group of their seedlings including the huge yellow *Midwest Star*, and the appropriately named *Orange Beauty*. Seedlings yet under number included a velvety bright red.

H. M. Hill and his son Robert of Lafontaine, Kansas brought some of their seedlings and displayed them between their parent flowers, which was most illuminating. A worthy offspring had resulted from crossing *Orange Beauty* and *Valiant*, two famous oranges. Hybrids of *Painted Lady* by *Hesperus* and *Golden West* were also intriguing.

Merritt Whitten's seedlings were exceptional for their tall scapes.



Fig. 177. A portion of the Growers' exhibits at the 1947 Midwest Hemerocallis Society Daylily Show.

Mt. Arbor Nursery, a large wholesale firm from Shenandoah, showed Leonian Hybrids and named Russell varieties which were shown to advantage in large flat metal trays covered with white material. Holes at intervals allowed the blossoms to reach damp moss below. This display was renewed the second morning.

Though the finest new varieties were conspicuously on display indoors and out, in gardens and as specimen blooms in bottles, a popular vote elected *Hyperion* as "Queen" of the Show! Runners up were *Midwest Star* (Sass) and *Painted Lady* (Russell). Apparently people who visited the Show still like their daylilies to be yellow.

Thanks to an unexpected and mercifully-timed cool spell everyone was able to enjoy the Official Test Garden which is located in full sun behind the KFNF radio studio on the grounds of the Henry Field Seed and Nursery Co. Most of the approximately 175 varieties were set the spring of 1947 so the blooms were not typical.

New officers of the society elected at the luncheon business meeting attended by 150 members are: Gretchen Harshbarger, president, North Liberty, Iowa; Viola Richards, Vice President, Greencastle, Indiana; Pearl Sherwood, Secretary-Treasurer, Atlantic, Iowa. Merritt Whitten of Nebraska City, Nebraska, will edit the Yearbook.

Believing that *Hemerocallis* are essentially a garden flower and should be studied in gardens for a full understanding, a group of regional garden tours are being planned for next summer. Members will be notified of dates and places in plenty of time to mark the dates on their calendars.

We want to thank the American Plant Life Society for their wonderful friendship and aid, and hope that as we mature and develop we can return the kindnesses in some measure.

[LEONIAN—Continued from page 25.]

Clemson College, and a period as Assistant Professor of Botany and Plant Pathology in the New Mexico State College and Experiment Station, he returned to the University of Michigan. There he studied mycology under Dr. Kaufmann and received the Ph. D. degree in 1922. That year he was appointed Assistant Plant Pathologist in the College of Agriculture and Experiment Station at West Virginia University. Here he became Professor of Mycology and Mycologist in the Experiment Station in 1936, the position he held to the time of his death.

As a scientist, Dr. Leonian's early work was with the study and control of certain plant diseases. His experience led him into studies of physiology of fungi, growth factors in fungi and bacteria, and, finally, into mineral and vitamin metabolism of some of the lower organisms. In the meantime he became interested in flower development as an avocation and over a period of twenty years did a great deal with delphiniums and oriental poppies as well as with the *Hemerocallis*.

2. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND
PHYLOGENY]

REVIEW OF PROCEDURES FOR DAYLILY DESCRIPTION, SCORING AND NAME REGISTRATION, 1940-1947

HAMILTON P. TRAUB

In 1940 the Society adopted the Official Data Card for the description of *Hemerocallis* clones (HERBERTIA 7: 98-102. 1940), and also a tentative daylily scoring procedure with the understanding that it was to serve as a starting point, and therefore subject to later revision (HERBERTIA 7: 125-128. 1940). The pages of HERBERTIA were opened for the registration of daylily names in 1935.

J. Marion Shull's important article in which he describes the use of the data card is reproduced in this issue of HERBERTIA for ready reference. Mr. Shull's work was so thoroughly done that it is not "dated" and reads as if it had just been written.

The scoring procedure adopted in 1940 has been used in the official daylily ratings made at the Regional Daylily Trial Garden, University of Florida, but World War II had already begun when the procedure was adopted, and daylily testing was suspended at most of the other trial gardens for the duration of the war. The work of testing has now been resumed at all of the trial gardens and the time has arrived when the scoring procedure should be reconsidered from the standpoint of any needed revisions by the Daylily Jury made up of those in charge of the Regional Daylily Trial Gardens.

The scale of points for rating daylilies (from HERBERTIA, 1940) is quoted below:

RATING SCHEDULE

All species and clones, from the standpoint of garden subjects, are to be given a numerical rating, using numbers from 1 to 10 for whole numbers, and decimals for values between whole numbers,—3.4; 6.5; 9.7; 6.8; 8.3, etc., depending on the merits of each species or clone as a garden subject. The following values are to be associated with the numerals:

Excellent	9.0 to 9.9
Good	8.0 to 8.9
Fair	7.6 to 7.9
Poor	7.5 and below

In making ratings use should be made of the scale of points for daylilies as set forth in the official score card (Table 1.). All clones rating lower than 7.6 should be considered as discards, but it should be

realized that clones that rate below 7.6 in one climatic region may rate much higher in another. Daylily ratings therefore are to be on a regional basis.

Table 1. Score Card for Rating Daylily Clones

[This score card was adopted in 1940, with the understanding that it “is subject to future revision and is to be considered as a starting point.”]

CHARACTER TO BE SCORED :	METHOD OF RATING :	POSSIBLE SCORE : 100
<i>Vigor</i> —Plant must be able to stand up under climatic conditions under which it is grown; if too weak, deduct at least $\frac{3}{4}$ of possible score		10
<i>Foliage</i> —Foliage should be considered from standpoint of its garden decorative value, but deciduous habit should not be penalized in the North		5
<i>Scape, and number of flowers to scape</i> —The flower should be considered from standpoint of sturdiness; should not be too sturdy nor too weak; however, such a scape as that of <i>Wau-Bun</i> should be considered as perfect for its type. Consider cleanliness; deduct $\frac{1}{2}$ of possible score if lacking in this particular		15
<i>Flower shape and form</i> —Many shapes will be recognized so long as they are beautiful		15
<i>Flower size</i> —All sizes of flowers will be recognized so long as they are well proportioned with reference to the scape—a small flower on a stout scape, for instance, is quite objectionable, and should be penalized a full 8 points		8
<i>Flower color and texture</i> —The main emphasis should be put on purity of color rather than on mere novelty		35*
<i>Flower odor</i> —If odor is absent or unpleasant, deduct points accordingly; if present and pleasant, count the full 2 points		2
<i>Flower durability</i> —If flower fades in morning in full sunshine, deduct 7 points; if it fades in afternoon, deduct 3 points. Flowers that do not fade or that improve in full sunshine are to receive the full 10 points		10

Dr. Brittingham, of the Texas A. & M. College, has amplified the score card and we look forward to the publication of his suggestions in 1948 HERBERTIA.

The adoption of an entirely satisfactory score card for the rating of ornamental plants presents many difficulties for artistic standards in such a rating system need to be broad enough to satisfy the great

* This has been weighted so that no clone with inferior flower color will pass.

majority. However, we should not throw up our hands in despair, but seek patiently for a workable standard.

In the meantime, it might be desirable to use a similar rating system at the trial gardens along the lines suggested for amateurs by Mr. Gilmer and the writer. Both of these articles appear in this issue of HERBERTIA. At least, the clones could be rated as "Fair," "Good" or "Excellent" for the particular climatic regions where they are tested, the standard used being set up by the one in charge of the trial garden.

The pages of HERBERTIA, since 1935, have been open for the registration of daylily names, and the recording of daylily descriptions. One of the chief objectives in mind was to prevent the use of the same name for more than one clone. To this end the project of a comprehensive Daylily Check List, from 1890, when the first named hybrid clone was introduced, to the present time, was undertaken by the Society. Dr. MacDaniels started the work in 1940, but on account of war work the project could not be completed, and Prof. Norton took up the work in 1943, carrying it along alone until 1946, when Mr. Stuntz joined him as collaborator. The work will be completed in the winter of 1947-1948, and the check list will be published in 1948.

In 1947, the Midwest Hemerocallis Society (organized in 1946) agreed to join the American Plant Life Society as joint sponsor of the Check List. For future consideration of common problems in connection with the registration of daylily names, an eight member joint committee, four from each organization, is being organized. Apparently other common problems from now on can be solved most efficiently by similar joint committees.

OFFICIAL DATA CARD FOR HEMEROCALLIS*

J. MARION SHULL, *Maryland*

Interest in the Daylily, or *Hemerocallis*, has grown by leaps and bounds in recent years and is still growing. The number of breeders now working with this interesting material have so multiplied their numbers and so extended the variation of color and form and habit of growth that ordinary methods of description have broken down, are no longer adequate to provide the desired means of comparison or differentiation.

This happens in any plant group under similar circumstances, and the daylily has now reached that stage where some uniform scheme of registry and description is necessary if useless and confusing duplications are to be avoided.

Already the leading commercial catalogs dealing with *Hemerocallis*

* The data card for daylilies here presented, prepared by J. Marion Shull, a member of the Daylily Committee, was officially adopted by the Board of Directors of the Society in 1940. This data card fills a long felt want, and Mr. Shull is to be congratulated on his excellent job. It is recommended that such a card properly filled out accompany each new request for registration, and that it be used to describe clones generally so that all descriptive work will be on a comparative basis.—Ed. [1940 foot-note]

[1947 foot-note] This article is reprinted from HERBERTIA 7: 98-102. 1940.

present many descriptions that do not sufficiently differentiate. Sometimes the same clone will be described on the basis of different salient features, or again two distinct clones may be described only to the extent of features in which they are similar and the reader is correspondingly confused or left unenlightened.

The data card here presented is designed to provide quick and accurate reporting of all clones on a basis that will permit instant close comparison one with another. To use the card it is only necessary to underscore the appropriate descriptive word, or if it is desired to indicate a position intermediate between them the underscore simply passes from one to the other. By this means a highly accurate description is available for quick reference. Where added information seems desirable it can be covered in the ample space left for remarks. To show how simply and accurately the Data Card operates, and to introduce its use to those working with *Hemerocallis*, Dr. Traub has kindly contributed one with nearly complete marking descriptive of his variety, *La Tulipe*. This is reproduced herewith as an illustration [Plate 304].

This Data Card is reasonably self explaining but what follows may help to secure a uniform and unhesitating interpretation. Name of clone is placed in upper left corner of the card, on both sides to serve as a guide for alphabetic filing and easy reference.

Under "growth" the plant as a whole in its vegetative performance is described. Weak growers will only seldom be listed, for unless some extreme merit of flower, blooming season, or what not, justifies perpetuation such weak growers should never be retained. "Habit" deals with the making of long or short rhizomes or runners, the former resulting in such aggressive spreading as shown in *Europa* and *Margaret Perry*, a trait that makes these and similar clones undesirable in the intimate garden, but great for broad landscaping, whereas those with short rhizomes form compact clumps that may remain many years with very slight encroachment on neighboring garden freeholders. Root characters are of less immediate importance in the garden but may help in identification of clones.

"Rate of increase," the rate of multiplication of new fans, varies no doubt partly with soils and climatic conditions but it is also a matter of hereditary difference. With me *George Yeld* is very slow of increase and *Mikado* quite the reverse.

Height of foliage mass does not refer to length of leaves but to the naturally standing mass which is of importance in landscape effect. Foliage may stand stiff and erect or may arch over gracefully, or it may actually sprawl, and these attitudes, with difference in normal color from yellow- to blue-green are of significance in the garden plant. Some remain with reduced but still green foliage throughout the winter and so are characterized as evergreen whereas clones like *H. Middendorffii* disappear entirely even by late summer and have earned the descriptive term "deciduous."

There is great variation in the scape or flowering stem. Of course all will lean over away from nearby shade and toward the light but even in the open some will arch over instead of standing erect, even to

AMERICAN AMARYLLIS SOCIETY OFFICIAL DATA CARD—HEMEROCALLIS

NAME La Tulipe WHERE GROWN Orlando, Fla.
 ORIGINATOR H. P. Traub INTRODUCER same YEAR 1939
 PARENTAGE Secured by using mixture of 25 or more pollens.
 GROWTH—Weak, moderate, vigorous. Habit: spreading, compact. Roots: fleshy, slender, cylindrical, fibrous; long, short. Rate of increase: slow, rapid. Height of foliage mass 1 1/2 ft.
 FOLIAGE—Erect, arching, recumbent; slender, broad; yellow-green, blue-green; evergreen, deciduous.
 SCAPE—Erect, drooping; slender, heavy, graceful, stiff. Branches: none, few, many compound.
 Height 2 1/2 ft. No. of buds 6-8 Season: early, medium, late. Bloom periods 2
 Date 1st bloom mid Apr., last Late June.
 FLOWER (as a whole)—Large, medium, small. Single, double. Front view: spidery, star-like, full.
 Side view: funnel, wide spread, recurved; regular, irregular, bizarre. Blooming: day, night, extended.
 Diameter as naturally standing 3" in. Fragrance: wanting, pronounced; pleasant, unpleasant.
 Carriage: vertical, horizontal. Fading: sun resistant. Quick shedding, persistent.
 *COLOR—Self, bicolor, polychrome, blend. Color effect in mass Dark Cardinal 6-2-8
 Segments: Petals _____ in. long; _____ in. wide. Color _____
 # Sepals _____ in. long; _____ in. wide. Color lighter Dark Cardinal
 Color of throat sulfur yellow Color of eye zone scarcely perceptible
 REMARKS + Flower vase shaped, and longer than wide;
Size of segments not determined so far
 SUBSTANCE—Thin, medium, heavy. TEXTURE—Smooth, crinkled, spangled.
 CHIEF MERITS OR OUTSTANDING QUALITIES. (OVER)
C. with distinct growth habit & flower shape

NAME La Tulipe AWARDS 1st. Class certificate
AAS 1940
 REMARKS IN GENERAL:
Beautiful and outstanding, but is most
important for further breeding work;
Fades somewhat in late afternoon
in full sun, and should be given
partial shade for best results.

* Refer to A Dictionary of Color by A. Maerz and M. R. Paul or to Royal Horticultural Society Colour Chart, when possible.

NAME OF PERSON REPORTING H. P. Traub
 DATE 11-15-40 ADDRESS U.S. Hort. Sta., Beltsville, Md.

For full description of card read article by J. Marion Shull in 1940 *Herbertia*. Fill in blank spaces and underline words which describe daylily named. Please give FULL INFORMATION.

Official Data Card for *Hemerocallis*, actual size as printed on two sides of a card (3 by 5 inches), showing front and reverse sides; filled out for the clone, **La Tulipe**. This shows how simply and completely the description can be made in spite of the small space allotted. Note under "Foliage," how a medium or intermediate between "slender" and "broad" is indicated; and again under "Flower," how the intermediate as to sun resistance is shown, and is re-inforced under "Remarks in General." [Completed card should now be sent to Prof. Norton or Mr. Stuntz.]

The Data were taken from a garden diary, and the card could not be completely filled out, lacking the flower-segment length and breadth data. Nor is the parentage indicated—in this case it is unknown as indicated.

the extreme of sprawling indicated by "recumbent." Some stems are slender and wiry, others thick, and either may be stiff or graceful in carriage. Branching may go all the way from capitate (wanting) as in *H. Middendorffii*, to compound as in *Queen Mary* and the multifloras. Compound branching is a prime quality for on this depends the number of blooms that may be out at one time as well as the total number of flowers per scape. Number of buds (flowers) will naturally be set at the maximum by the person reporting and this is all right except that stems obviously abnormal, such as may sometimes result from fascination or possibly from frost injury, should not be made the basis of bud count.

In the lower South some clones bloom repeatedly and even in more northern latitudes some at least occasionally bloom a second time, so provision is made of noting this feature under "blooming periods," but this is not to be confused with date of first bloom in locality where reported.

It is not possible to cover every variation of flower character but the principal characteristics are here included. By "spidery" is meant a flower whose segments are long and strap-like. With somewhat wider and pointed segments the flower becomes "star-like", while the term "full" has long been in use for flowers with broad or decidedly overlapping segments. This description is further augmented under petals and sepals where provision is made for actual measurement of length and width.

The "side view" is more variable but several main attitudes are provided for on the way from a narrowly open *Cissy Giuseppe* to the wide-spread and recurved *Shirley*. Aside from the general aspect there may be great irregularity of carriage owing variously to a long thrust-out lower segment, an unusual angle of flower face, the twisting or curling of segments, or something of a hose-in-hose effect where petals and sepals bend back at different levels. Clones like *Ophir* and *Sir Michael Foster* are quite regular but *Wau-Bun* and others may be designated as "irregular" or even "bizarre" with added mention under "remarks" when desirable.

Under "blooming" reference is had to the time of day during which flowers are effective. Day bloomers are those that open in the morning and close by evening or night and include the great bulk of the effective garden varieties. Even among these there is considerable variation. *Europa* is a sleepy-head, not well open till around nine o'clock, and retires fairly early in the evening. Many others open during the night, greet the break of day fully out, and remain in full display till after dusk. Others like *Calypso* open in the afternoon or evening and remain till ten o'clock or noon of the following day, dependent somewhat on light and temperature. These are the most useful of the night bloomers. An occasional night bloomer operates only at night and over a short period, not open until dusk and gone before morning, and are only useful for gardens enjoyed at night or for cut flowers at night, when most daylilies are a dead loss. For those few whose periods extend twenty-four hours or more the term "extended" is used.

“Carriage” covers flower position relative to the stem and is almost though not quite as varied as in the liliiums.

Many daylilies bleach or fade in hot bright sunshine. Lemon yellow may bleach to near white by midafternoon—but that does not warrant describing them as “white” daylilies. Darker colors are more likely to suffer because they absorb more heat than do lighter colors. These are apt to face to more nearly the color of manilla wrapping paper. In a few cases the so-called “pink” daylilies become more nearly pink in late afternoon than in the morning—may in rare instances be a lovelier color than before fading. Others both dark and light remain practically unaffected by the sun. A clone need not be discarded because it lacks resistance to strong sunshine but this weakness needs to be known and the variety given a position in whole or at least partial shade.

After blooming, those clones are most useful that drop their spent flowers quickly so provision is made for recording desirable quick shedding or indicating the persistence of spent flowers which gives a messy, unclean appearance unless deliberate care is taken to remove them day by day.

Under “color” four general types are recognized; the selfs in which there is no marked variation from one color throughout the segments. Clones like *Hyperion*, *Goldeni*, *Ophir*, are typical selfs, the greenish tone at throat not voiding the term. “Bicolor” best applies to those wherein the color of petal segments is notably different from that of the sepals. With several distinct colors prominent in the same flower the term “polychrome” is correct. “Blend”, on the other hand, is not so definite. It can only mean a more or less actual blending of such colors as occur habitually in daylilies, where the colors do not stand out clearly against each other or in definite patterns. It can not be specific as in Iris where “blend” means the combining of yellow with anthocyanin purples. Still it will be a useful descriptive term in certain cases. Special pattern or peculiarities of color arrangement must be left for inclusion under “remarks”.

When possible the color of petals and sepals should be recorded in terms of a standard color nomenclature (A Dictionary of Color, by A. Marez and M. R. Paul; or the “Royal Horticultural Society Colour Chart”), but aside from these more minute details a given variety will possess a mass color value, as lemon yellow, golden, orange, brown, etc., in garden effect, and for this reason a place is provided for recording this broader statement of color. A *Mikado*, despite its striking petal spots, may still classify as yellow in mass.

In some varieties the throat color is quite distinct and in many there is a heightening of color on petals just beyond the throat producing a roughly circular or triangular eye effect that has come to be known as the “eye-zone”. It may be so faint as to be scarcely distinguishable or it may be very pronounced. It may be an enhancement or a detracting but in either case it provides a useful mark of varietal differentiation and when distinctive needs to be included in the description.

Substance and texture may seem of minor importance in a flower that lasts but a day. However, texture, the peculiar variations of flower surfaces, may be of considerable value at close range, where the spangled

or gold dust effect, or a pattern of intricate crinkling may be fully appreciated.

The card still leaves some voids, such as the occasional distinctive midrib, the color of unopened buds, or the differing color of the outer surfaces of segments, but these rarer items can best be taken care of under "remarks".

For the sake of future development it would be desirable to have all older clones subjected to a uniform description made possible by this data card at as early a date as possible, and then it might be well to stipulate that a properly scored card be filed with each new request for registration.

REPORTS FROM REGIONAL DAYLILY TRIAL GARDENS

[Reports from a number of Regional Daylily Trial Gardens have been received, and are reproduced below.] See also page 156.

1. EVALUATION OF DAYLILIES FOR NORTHERN FLORIDA

JOHN V. WATKINS, *Assistant Professor of Horticulture,
University of Florida*

These evaluations are based on observations made and data taken in the Daylily Display Garden on the campus of the University of Florida, in the garden of the writer and in the garden of friends. The ratings have been arrived at after much deliberation and are greatly influenced by the remarks of fellow gardeners. In arriving at numerical values, the official score card for rating daylily clones on page 126, 1940 HERBERTIA has been used.

Table 1.—Additional Daylily Evaluations for Northern Florida, 1947.

<i>Aladdin</i>	8.4	<i>Honey Redhead</i>	8.6
<i>Amberst</i>	9.1	<i>Indian Chief</i>	9.1
<i>Annis Victoria Russell</i>	8.6	<i>La Tulipe</i>	9.1
<i>Baronet</i>	9.6	<i>Lidice</i>	8.1
<i>Black Falcon</i>	9.1	<i>Mayor Starzynski</i>	8.4
<i>Bobolink</i>	9.1	<i>Mignon</i>	7.0
<i>Brackel</i>	9.0	<i>Minnie</i>	8.3
<i>Brunette</i>	7.1	<i>Monarch</i>	7.8
<i>Buckeye</i>	7.1	<i>Nebraska</i>	8.5
<i>Cabellero</i>	9.6	<i>Obred</i>	9.0
<i>Clayton No. 1</i>	9.0	<i>Peony Red</i>	8.4
<i>Crystal Fairy</i>	8.7	<i>Royal Ruby</i>	9.5
<i>Daisy Whistler</i>	8.4	<i>Ruby Supreme</i>	9.6
<i>Dolly Varden</i>	8.4	<i>Sachem</i>	9.6
<i>Duchess of Windsor</i>	9.0	<i>San Juan</i>	9.6
<i>Easter Morn</i>	9.5	<i>Scarlett O'Hara</i>	9.1
<i>Fire Red</i>	8.1	<i>Stampede</i>	9.1
<i>Ganymede</i>	9.4	<i>Symphony</i>	8.6
<i>General MacArthur</i>	9.1	<i>Theodore Mead</i>	9.4
<i>Hesperus</i>	8.5	<i>Triumph</i>	8.1
<i>Halo</i>	8.5	<i>Wekiwa</i>	8.6
<i>Herkimer Johnson</i>	8.4	<i>Zouave</i>	8.1

Table 2.—Daylily Winter Foliage Character in Northern Florida

[F=full garden value throughout winter; s=lacking in winter garden value.]

F	<i>Annis Victoria Russell</i>	F	<i>La Tulipe</i>
F	<i>Aladdin</i>	F	<i>Lady Franklin</i>
F	<i>Araby</i>	F	<i>Lidice</i>
F	<i>Aurillo</i>	F	<i>Mayor Starzynski</i>
s	<i>Black Falcon</i>	s	<i>Mignon</i>
s	<i>Brunette</i>	s	<i>Mildred Orpet</i>
s	<i>Buckeye</i>	s	<i>Minnie</i>
F	<i>Caballero</i>	F	<i>Miss Jennie</i>
s	<i>Caralline</i>	s	<i>Monarch</i>
F	<i>Carnival</i>	s	<i>Moonbeam</i>
F	<i>Clayton I</i>	s	<i>Mongol</i>
F	<i>Cleo</i>	s	<i>Nebraska</i>
s	<i>Corinne</i>	F	<i>Obred</i>
s	<i>Craemore Henna</i>	F	<i>Paul Ibrig</i>
F	<i>Daisy Whistler</i>	F	<i>Peony Red</i>
s	<i>Dolly Varden</i>	s	<i>Pink Lass</i>
F	<i>Dr. Stout</i>	s	<i>Pink Lustre</i>
F	<i>Duchess of Windsor</i>	F	<i>Reba Cooper</i>
F	<i>Duncan</i>	s	<i>Revolute</i>
F	<i>Elaine</i>	F	<i>Rouge Vermillion</i>
F	<i>Emberglow</i>	F	<i>Ruby Supreme</i>
F	<i>Estelle Friend</i>	F	<i>Russell Wolfe</i>
F	<i>Fire Red</i>	F	<i>Sachem</i>
F	<i>Fred Howard</i>	F	<i>San Juan</i>
F	<i>Garden Lady</i>	F	<i>Scarlet O'Hara</i>
F	<i>General MacArthur</i>	s	<i>Symphony</i>
F	<i>George Kelso</i>	s	<i>Takoma</i>
F	<i>Golden Glow</i>	F	<i>The Yearling</i>
F	<i>Granada</i>	F	<i>Theodore Mead</i>
s	<i>Helen Wheeler</i>	F	<i>Triumph</i>
s	<i>Hesperus</i>	F	<i>Victory Montevideo</i>
s	<i>Honey Red Head</i>	s	<i>Wekiwa</i>
F	<i>Indian Chief</i>	F	<i>Welaka</i>
F	<i>Jimmie Junior</i>	s	<i>White Lady</i>
s	<i>John Blaser</i>	F	<i>Yeldrin</i>
F	<i>Kanapaha</i>	F	<i>Zouave</i>

DAYLILY DISPLAY GARDEN AT THE UNIVERSITY OF FLORIDA

The Daylily Display Garden at the University of Florida, which was started in the early thirties, is still a feature of the campus, although, today, it is restricted to two long borders. Table 3 shows that only twenty-eight varieties and one species are on display in 1947. This reduction is made necessary by the labor situation and the greatly increased enrollment at the University.

Since the Regional Test Gardens were conceived, the unit here has been maintained in the best possible spirit and tradition. Annually, collections have been sent out to the other gardens, seedlings have been received for valuation from the following breeders—Hayward, Norton, Taylor, Traub, Watkins and Wheeler. Ratings for many of these seedlings have been published in HERBERTIA, others can be found in Table 1.

Following the January, 1947 renovation, hundreds of divisions of commercial varieties of Hemerocallis were distributed among the married students who reside in the veterans' housing units on the campus of

the University of Florida. These young people eagerly accepted these plants and it is hoped that an interest in *Hemerocallis* may be developed by some of our students as they live with these worthy perennials during their college years.

Table 3.—Daylilies in the Display Garden—University of Florida, 1947

<i>Baronet</i>	<i>Mrs. John J. Tigert</i>
<i>Bertrand Farr</i>	<i>Parthenope</i>
<i>Bicolor</i>	<i>Patricia</i>
<i>Cabellero</i>	<i>Port</i>
<i>Cypriana</i>	<i>Radiant</i>
<i>Dauntless</i>	<i>Ruby Supreme</i>
<i>Duncan</i>	<i>Sachem</i>
<i>Emily Hume</i>	<i>San Juan</i>
<i>General MacArthur</i>	<i>Semperflorens</i>
<i>Hemerocallis aurantiaca</i>	<i>Serenade</i>
<i>Kanapaha</i>	<i>Sir Michael Foster</i>
<i>La Tulipe</i>	<i>Swan</i>
<i>Linda</i>	<i>Vulcan</i>
<i>Marcelle</i>	<i>Welaka</i>
<i>Mildred Orpet</i>	

2. DAYLILY TRIAL GARDEN AT SOUTHWESTERN LOUISIANA INSTITUTE

IRA S. NELSON, *Professor of Horticulture*

A trial garden or test garden for daylilies was established by the Society at Southwestern Louisiana Institute, Lafayette, Louisiana in 1942. While this garden has never developed to its full stature, it has served in no small way as a display garden. During the war years it often was neglected for weeks at a time. Few records of the various varieties were kept. Labels often became misplaced and very few varieties were added after 1943. Yet, in spite of all these handicaps, and in spite of all the evils which accompany a war, this garden was visited frequently by people of the Gulf coastal area.

In looking back over the past few years, I wish to record a few things concerning this garden which may not only be of general interest, but also of some specific value to those who will determine the policy of this and similar gardens in the future.

Since there was no specific plan given for the planting of the garden, it was laid out in beds which measured five by twenty feet. Grass walks five feet wide separated the beds. This size bed was used to conform to the other beds in the floriculture unit at S. L. I. While the size bed may not be the most desirable, it has proved to be thoroughly useable. These beds each accommodate 42 plants at 18 inch intervals. A space of 9 inches was left between the ends of the bed and the plants and 12 inches on the sides. The original plan called for ultimately placing 9 plants of each variety in a block. Most of the varieties, however, were planted in blocks of three running the narrow way of the bed. Blocks of three plants each proved sufficient volume of each variety for

adequate display. Little difficulty has been experienced to date in keeping the varieties in bounds.

Approximately 100 varieties are growing in the garden. Many of these are near duplicates. Although some few are rather outstanding, the bulk of them are little better than could be expected from an equal number of seedlings from good parent stock. Most of the varieties have long been in the trade and do not represent the newer developments. However, a few of the Traub varieties, which are in the garden are standouts.

Each season the garden has attracted a considerable number of visitors. There is now evidence in the gardens of this section of the country that this trial garden is stimulating the daylily enthusiasm.

Besides serving as a display garden, it has been a source of pollen for amateur hybridizers. This function may bear richer fruits than its other functions. Pollen has been given freely to all who have asked for it.

Of the few records kept only those giving the date of first bloom are worth recording here. Bloom dates were taken only on the varieties which bloomed in 1943. It should be pointed out here that most varieties after becoming established will bloom twice a year in Lafayette, Louisiana. Some few will bloom three times per year. Winter temperatures at Lafayette seldom get below 20° F. An occasional 15° F. may be expected every 5 to 10 years. Heavy frost may be frequent in some winters, but hard freezes occur only a few times a year if at all. Winter temperatures experienced in Lafayette do not seem to have any permanent effect on any of the varieties included in the trial garden. Evergreen varieties seem to multiply at a more rapid rate than many of the deciduous sorts.

The floriculture unit at Southwestern Louisiana Institute is being moved to new quarters to make way for a mid-winter fair building. The daylily trial garden also is being moved at the same time. The new garden will be laid out in a similar pattern to the present garden. The ordeal of moving the garden should be completed by September 1st. August seems to be an ideal time to move day lilies in this section.

By way of evaluating the trial garden for the duration of the war years, it can be honestly said that it aroused a great deal of interest in daylilies simply by having varieties unknown to this section on display. As a source of pollen it stimulated considerable interest in amateur hybridizing. The garden fell short in that it has not been kept up to date and very few records have been kept on performance of varieties.

HEMEROCALLIS NOTES, 1943

Clone	Date of First Bloom	Scape
<i>Aurantica</i>	May 1	Strong—30"-34"
<i>Amarillo</i>	May 5	Strong—30"-32"
<i>Amaryllis</i>	May 21	26"-28"
<i>Bijou</i>	May 18	28"-30"

<i>Bagdad</i>	June 10	
<i>Cinnabar</i>	May 17	24"-26"
<i>Cressida</i>	May 16	Strong—26"-28"
<i>Crown Prince</i>	May 9	Strong—28"-30"
<i>Dawn Play</i>	June 10	
<i>D. D. Wyman</i>	June 10	
<i>Dauntless</i>	June 12	
<i>Estmere</i>	March 16	
<i>E. H. Bowles</i>	June 11	
<i>Emily Hume</i>	May 17	26"-28"
<i>Flava</i>	May 19	Weak 24"-26"
<i>Fulva Rosea</i>	June 10	
<i>Gelbett Seedling No. I</i>	May 22	Strong—28"-30"
<i>Gelbett Seedling No. II</i>	May 20	Strong—34"-36"
<i>Gelbett Seedling No. IV</i>	May 23	Strong—24"-26"
<i>Gelbett Seedling No. X</i>	May 23	Strong—24"-26"
<i>Goldeni</i>	May 5	Weak 4"
<i>Gem</i>	April 27	28"-30"
<i>Hyperion</i>	June 12	
<i>Iris Perry</i>	May 20	26"-28"
<i>Imperator</i>	May 20	28"-30"
<i>J. R. Mann</i>	April 20	24"-26"
<i>J. A. Crawford</i>	May 5	34"-36"
<i>Linda</i>	June 12	
<i>Lemona</i>	April 8	Weak 20"-24"
<i>Mikado</i>		Medium 18"-20"
<i>Maggie Napoleonville</i>	April 26	Firm 28"-30"
<i>Margaret Perry</i>	May 21	Strong
<i>Modesty</i>		Short
<i>Midas</i>	May 22	Short
<i>Mrs. A. H. Austin</i>	June 14	
<i>Mrs. John Tigert</i>		Uneven strong
<i>Multiflora Summer Hybrids</i>	May 22	Weak
<i>Ophir</i>	April 20	Strong—28"-30"
<i>Orange Vase</i>	April 27	Very short
<i>Patricia</i>	May 20	Strong—28"-30"
<i>Rajah</i>	June 14	Weak
<i>Sunkiss</i>	April 27	Strong—34"
<i>Serenade</i>	May 13	Weak 26"-28"
<i>Sweet Briar</i>	May 20	Strong—34"-36"
<i>Semperflorens</i>	April 27	Strong—28"-30"

<i>Sir Michael Foster</i>	June 7	Strong—30"-34"
<i>Thelma Perry</i>	May 19	Slender Weak
<i>Vesta</i>	May 14	Weak
<i>Vicountess Byng</i>	May 16	Weak
<i>Vulcan</i>	May 1	30"-34"

3. DAYLILIES IN SOUTHERN CALIFORNIA

W. QUINN BUCK,

*Division of Ornamental Horticulture, College of Agriculture,
University of California at Los Angeles.*

The great colonies of *Hemerocallis fulva* clone *Europa* along the roadsides and near an old stone farmhouse in Pennsylvania first aroused my interest in the genus, and I cannot help regreting that our growing conditions here are less favorable to such incredible luxuriance.

Our moderate winters do not give enough winter chilling for some; our cool nights seem to affect certain varieties so that they do not open perfectly or with full color intensity; and our dry summers necessitate vigilance by the grower to see that the plants get sufficient water.

Hemerocallis flava and *Hemerocallis minor*, and probably *H. Forresti*, do not grow and flower normally due to insufficient winter chilling. *Gold Dust* and *Sovereign* are two of the older varieties which do not get sufficient cold. *Wekiwa* does not have the depth of color here that it has further inland or in the East. *Nebraska* seldom opens well, and *Araby* and *Sybil* have a rolling or curling of the petals that spoils the shape. These factors and my own personal tastes are the basis of the classifications below.

The daylilies which seem to be excellent and those best adapted to Southern California include the following:

Chengtu	Golden West	Mikado	Sonny	Wau-Bun
Dauntless	Hesperus	Patricia	Soudan	
Fulva	Kanapaha	Purple Finch	Swan	
Fulva maculata	Linda	Rajah	Taruga	
Fulva rosea	Majestic	Royal Ruby	Triumph	

Clones which would be classed as very good include these:

Afterglow	Debutante	Honey Redhead	Purple Flash	The Alamo
Aladdin	Dominion	Hyperion	Revolute	Valiant
Aurantiaca	Dorthy McDade	J. A. Crawford	Royal	Warpath
Baronet	E. W. Yandre	J. R. Mann	Royalty	Warrior
B. H. Farr	Festival	Mayor Starzynski	Sachem	Welaka
Black Falcon	Garden Lady	Morocco Red	San Juan	Winsome
Buccaneer	The Gem	Mrs. A. H. Austin	Sir Michael Foster	Yeldrin
Buckeye	Golden Bell	Mrs. John Tigert	Stalwart	Zouave
Caballero	Golden Dream	Mrs. W. H. Wyman	Su-Lin	

Chrome Orange Gold Imperial Multiflora Supreme
Criterion Hankow Port Symphony

Varieties sufficiently good to warrant use in our gardens make up this group:

Amaryllis	Dazzler	Golden Shadows	Mongol	Radiant
Anna Betscher	Demon	Heather Rose	Moonbeam	Regal Lady
Bagdad	Dr. Stout	Hiawatha	Old Vintage	Spitfire
Burning Star	Earliana	Imperator	Pink Lustre	Sundew
Cinnabar	Emily Hume	Ivory Chalice	Purple Waters	Theron
Circe	Geo. Yeld	Margaret Perry	Pygmean	Vulcan

A last classification is of those which are poor and some which are worthless in the garden. Some of these may be quite good in other sections of the country.

Annis Victoria Russell	Dark Eyes	Minor	Rosita	Viscountess Byng
Araby	Dawn	Mrs. Jones	Serenade	Wekiwa
Boutonniere	Evangeline	Multiflora Sum. Hyb.	Sovereign	White Lady
Brunette	Fair Morn	Nebraska	Sunset	
Calypso	Florida	Nocerensis	Sunny West	
Cecil Houdyshel	Gold Dust	Peachblow	Sybil	
Cissy Guiseppi	Melo	Princess	Thunbergii	

Mrs. Nesmith's *Royal Ruby* and *Purple Finch* are fine reds. Dr. Stout's *Majestic* is a wonderful thing, and his *Triumph* is another fine orange. *Soudan* (Stout) is unquestionably the best daylily we grow here because it is so well adapted to our climate and is such a beautiful variety.

THE DAYLILY CHECK LIST

M. FREDERICK STUNTZ, (*Compiler*)

While it seems that it should have been possible to publish the list of daylilies during the time since this project was first started there are many good reasons why this has not been accomplished.

1. Simply a list of names with no evidence of origin or identification of clones would be of little value; although such a list could be published immediately.
2. The production of new varieties has been greater than we imagined; and to trace and record the source of over 3,000 names has required more time than was anticipated.
3. There have been many duplications, new clones having been given names already applied to others. This often requires considerable correspondence in order to find out who has prior right to retain the name; and to record the new name chosen by the originator to replace the one duplicated. These synonyms will be cross referenced in the Daylily Check List. Most of such duplications can be prevented when the Check List is available.

4. While practically everyone who has named daylilies did cooperate there are about a half dozen that have not sent us their complete lists. While we have been able, by the assistance of friends who have loaned us lists and catalogues, to identify most of the names, there are many new ones not published, which should be included to make the Check List complete; and we hope that these breeders will realize that it is to their advantage to have all varieties recorded.

5. Work has had to be suspended during the summer months when both Prof. Norton and Mr. Stuntz, who together are charged with the preparation of the Check List, must devote most of their time to their Gardens.

6. All of this work is done in the "spare" time of the compilers and without pecuniary compensation; but we hope to assemble the data necessary for the printer during the coming year.

In the meantime we trust that you will cooperate with us; and that all persons who contemplate naming new seedlings will send the names to Mr. Stuntz. After the names have been checked with our files to avoid duplications, the brief description necessary to make the names valid should be sent. This includes height, season, color; also when known—parentage, time of day or night blooming, fragrance, whether day or night blooming, and address of introducer.

Address: M. Frederick Stuntz, 6505 Main St., Williamsville 21, N. Y.

GENERAL COMPARISON OF DAYLILIES AND 1947 BLOOMING RECORDS

GEORGE GILMER, *Virginia*

GRADE A CLONES

Grade A means outstanding by comparison with my other plants of the same color and season of bloom. *Gold Dust* is rated A because I have nothing better at such an early date. It blooms under all conditions. A record breaking freeze this year withered stems of *Wau-Bun* with buds over two inches long and did not hurt *Gold Dust*. If it bloomed a month later it would be discontinued.

To rate at all plants must have beautiful bloom in the morning. To rate A they should have bloom at 5:00 P. M., uninjured by our hottest sun. A few of Grade A reds and pinks are slightly injured by a full day of bright sun. They will be moved to Grade B or discontinued in most cases, as soon as those on trial are rated. Perhaps a third or more of the A's will be moved to Grade B or discontinued in the next three years.

Some of the plants rated A may be rated B or even less by others who have had these trial plants long enough to rate them. Some that I rate B may be rated A by others, because they do not have all my A's or because they do not object as much as I do to afternoon fading or poor foliage in summer or autumn or because of different conditions of climate, soil or judgment of values.

GRADE B CLONES

Grade B are good plants but have some weakness such as afternoon fading, poor foliage at some season, or not as good as similar A plants. In general if lost they would not be replaced, but they are too good or too different to discard as yet. Practically all B's would have rated A ten years ago and a goodly number would have gotten A grade even five years ago. As soon as the grading of sixty-one now on trial is completed at least a dozen grade A will step down to B and this will push about the same number of B's into the discontinued class, now numbering 69. Others on trial will rate B and cause more B's to be dropped.

In three years I expect at least two-thirds of B's to be discontinued. Some B's might be rated A by others because they do not have my A plants that push them down or because of a different system of valuation and personal choice of colors, form, climatic conditions, etc.

Rating is a relative matter. The standing of all plants where improvement is as rapid as in daylilies is fluid. Many new plants are introduced each year. The hybridizer in most cases believes his plant similar to the one now in commerce, but superior. Each time he is right it means a lower rating or discontinuance of some other plant. With more than three thousand introductions there is a slim chance of any superior new plant being so distinctive as not to affect the standing of some now in commerce.

T=UNDER TRIAL

This means that a plant is still under observation with its rating undetermined. I try to add a dozen or more varieties each year in my trial list.

DISCONTINUED

I have not named those discontinued. If nothing good can be said it is generally best to keep quiet. There is little chance warning buyers against all of 90% of some three thousand introductions no longer worth growing. That leaves 300 or more. I can hardly think that there are that many good ones sufficiently different to be worth growing at this time. Therefore, naming some 69 I have dropped out of such a great quantity could serve no useful purpose. And besides, some of these discards may prove to be good or excellent in other climatic regions.

GRADE A AND B CLONES, AND CLONES UNDER TRIAL

Adventure (T); *Afterglow* (B), fades, otherwise A; *Aladdin* (A); *Anna Zenger* (T); *Annis Victoria* (A); *Apricot* (B); *August Orange* (T); *August Pioneer* (A); rated A because late bloomer; *Autumn Prince* (B);

Baghdad (B); *Bagette* (T); *Baronet* (T); *Bertrand Farr* (B), fades and poor foliage late in season, otherwise A; *Berwyn* (T); *Betscher No. 5* (T); *Betty* (T); *Black Prince* (B); *Blanche Hooker* (T); *Boutonniere* (B);

Carnival (Traub) (A); *Chengtu* (A), blooms late and different foliage and growth; *Cinnabar* (B); *Circe* (B); *Clarice* (B); *Clarinda* (T); *Colleena* (B); *Colonel Besby* (T); promising; *Corinne Robinson* (B); *Crown of Gold* (B), rated B because earlier than most; *Dauntless* (A); *Dawn O'Day* (T); *Dr. Stout* (A); *Dorothy McDade* (A), good late yellow; *Duchess of Windsor* (A);

Earlianna (T); *Elaine* (B); *El Capitan* (T); *Elizabeth* (T); *Emberglow* (A); *Emily Dickinson* (T); *Evangeline* (T);

Fantasia (T); *Festival* (B); *Fire Red* (A), no fading; *Flava* (B), would discontinue if not so early; *Fred Howard* (A); *Fulva Maculata* (B); *Gay Troubador* (T); *Genevieve* (A), excellent but not introduced by Norton as yet; *George Kelso* (A); *Georgia* (A), one of Dr. Stout's best; unexcelled; *Gita* (T); *Gold Dust* (A), earliest; not midseason quality; *Gold Empire* (T); *Golden Fleece* (B), similar to *Dorothy McDade*; *Golden Triangle* (T); *Granada* (A);

Hankow (A), rated A because late; *Helen Wheeler* (A); *Honey Red Head* (T);

Indian Chief (A); *In Flight* (B); *Iowa* (T);

John Blaser (T); *Joy Russell* (A), good late light yellow;

Krishna (T);

Lamar Russell (T); *La Tulipe* (B); *Lemon Tulip* (T); *Lidice* (A); *Linda*, dull color, long blooming season;

Majestic (B); *Malcolm Russell* (B); *Manchu* (T); *Margaret Palmer* (T); *Massasoit* (B), one of the tallest; *Matador* (A); *Mayor Starzynski* (A); *Mexico* (T); *Midas* (B); *H. Middendorffii* (B), species; *Mignon* (T); *Mikado* (B); *Mildred Orpet* (B); *Minnie* (B); *Mission Bells* (T); *Mitra* (T); *Monterey* (T); *Mount Vernon* (T); *Mrs. B. F. Bonner* (A); *Miss Welder* (B); *Mykawa* (T);

Now Glory (T);

Omaha (T); *Ophir* (B);

Portia (T); my son's seedling, so I do not rate; *Papagaio* (T); *Patricia* (A); *Peony Red* (B); *Pierre Sue* (T); *Pink Charm* (B); *Play Time* (B); *Port* (B); *Princess* (B); *Purity* (T); *Purple Waters* (B); will keep until one nearer purple can be found.

Queen of Gonzales (A); *Queen of May* (T); *Queen of Monterey* (T), will not rate above B; *Queen Wilhelmina* (A);

Rajah (A); *Ranchio Diana* (B), small flowers freely produced; *Reba Cooper* (A); *Red Bird* (A); *Red Gem* (T); *Reinbeck* (T); *Richard* (T); *Rosalind* (B); *Rose Gem* (T); *Royalty* (B); *Russell Wolfe* (B);

Sachem (B); *Saffron Yellow* (T); *San Juan* (A); *Santa Lucia* (T); *Santa Maria* (A), wrong label, true name unknown; *Serenade* (B); *Sonny* (B); *Soudan* (B); *Spit Fire* (T); *Spring Delight* (T); *Stalwart* (A); *Stephen Foster* (T); *Summer Eve* (B); like *Genevieve* but not as good; *Sunkist* (T); *Susanna* (T); *Sweetbriar* (A); *Sylvia* (T); *Symphony* (B);

Tara (A); *Taruga* (A); *Tejas* (T); *Theodore Mead* (A); *Theron* (B);

Valeria (T); *Victory Montevideo* (A); *Vivian Toole* (T); *Vivossa*

(B); *Vulcan* (B); fades;

War Path (A), excellent red; *Wau-Bun* (A); *Wekiwa* (A), excellent red; *Wolof* (B).

DAYLILY BLOOMING RECORDS, 1947

None are entered unless they are grown on well established plants. Dates are for main crop bloom. A rare early or late recurrent bloom is omitted. Height of foliage and height of scape (bloom) are indicated in inches.

Gold Dust—May 10 to May 27; Height foliage 20; Height bloom 23.

Aladdin—May 25 to June 15; also some September bloom; Height foliage 22; Bloom 25.

Wau-Bun—May 30 to June 27; Height foliage 21; Bloom 25.

Victory Montevideo—May 31 to June 18; Height foliage 17; Bloom 26.

Symphony—May 29 to June 12; Height foliage 24; Bloom 31.

Lidice—June 2 to July 6, Height foliage 20; Bloom 20.

Bagdad—June 2 to July 1; Height foliage 30; Bloom 40.

Queen of Gonzales—June 9 to June 19; Height foliage 24; Bloom 28.

Serenade—June 9 to June 28; Height foliage 25; Bloom 35.

Dominion—June 9 to June 29; Height foliage 17; Bloom 26.

Caballero—June 10 to July 20; Height foliage 22; Bloom 35.

Starlight—June 10 to July 5; Height foliage 28; Bloom 36.

Midas—June 10 to July 1; Height foliage 24; Bloom 36.

Theodore Mead—June 10 to June 26; Height foliage 20; Bloom 27.

Fred Howard—June 11 to July 16; Height foliage 18; Bloom 24.

La Tulipe—June 11 to July 15; Height foliage 22, Bloom 26.

Mrs. A. H. Austin—June 11 to July 6, Height 24; Bloom 35.

Mikado—June 11 to July 1; Height of foliage 24; Bloom 36.

Saturn—June 12 to July 2; Height of foliage 21; Bloom 34.

Sachem—June 14 to June 29; Height foliage 23; Bloom 26.

Spring Delight—June 14 to July 20; Height foliage

Festival—June 14 to July 18; Height foliage 30; Bloom 36.

Linda—June 14 to July 21; Height foliage 20; Bloom 35.

War Path—June 15 to July 12; Height foliage 24; Bloom 30. Should be taller on larger plants.

Persian Princess—June 15 to July 12; Height foliage 25; Bloom 33.

Reba Cooper—June 15 to July 2; Height foliage 24; Bloom 32.

Purple Waters—June 17 to July 13; Height foliage 25; Bloom 29.

Vulcan—June 16 to July 14; Height foliage 22; Bloom 30.

Oscoela II—June 19 to July 3; Height foliage 20; Bloom 29.

Mayor Starzynski—June 20 to July 14; Height foliage 22, Bloom 35.

Massasoit—June 21 to July 15; Height foliage 33; Bloom 66.

- San Juan*—June 21 to July 12; Height foliage 30; Bloom 38.
- Lustrous*—June 20 to July 17; Height foliage 26; Bloom 35.
- Patricia*—June 23 to July 19; Height foliage 20; Bloom 32.
- Sweet Briar*—June 23 to July 17; Height foliage 30; Bloom 36.
- Dauntless*—June 25 to July 15; Height foliage 20; Bloom 26.
- Majestic*—June 25 to July 14; Height foliage 25; Bloom 33.
- Duchess of Windsor*—June 27 to July 20; Height foliage 20; Bloom 26.
- Tara*—June 26 to July 19; Height foliage 24; Bloom 35.
- Wekiwa*—June 26 to July 29; Height foliage 24; Bloom 36.
- Indian Chief*—June 26 to July 10; Height foliage 23; Bloom 30.
- Rajah*—June 27 to July 26; Height foliage 20; Bloom 33.
- Fire Red*—June 28 to July 15; Height foliage 25; Bloom 35.
- Rosalind*—June 28 to July 21; Height foliage 24; Bloom 36.
- Mongol*—June 29 to July 29; Height foliage 23; Bloom 42.
- Stalwart*—June 28 to July 27; Height foliage 30; Bloom 50.
- Annis Victoria*—June 25 to July 13; Height foliage 23; Bloom 35.
- Afterglow*—June 29 to July 11; Height foliage 26; Bloom 42.
- Linda*—June 29 to July 20; Height foliage 20; Bloom 36.
- Vivosa*—June 30 to July 16; Height foliage 26; Bloom 36.
- Purple Elf*—June 30 to July 16; Height foliage 27; Bloom 45.
- Granada*—June 30 to July 20; Height foliage 20; Bloom 42.
- Dr. Stout*—June 30 to July 26; Height foliage 32; Bloom 36.
- Mission Bells*—June 30 to July 10; Height foliage 20; Bloom 25. Less than one year old.
- Princess*—June 30 to July 12; Height foliage 26; Bloom 30.
- Red Bird*—June 30 to July 15; Height foliage 20; Bloom 31.
- Corrine Robinson*—July 2 to July 18; Height foliage 25; Bloom 29.
- Rancho Diana*—June 19 to July 10; Height foliage 22; Bloom 28.
- Genevieve*—June 20 to July 21; Height foliage 36; Bloom 40.
- Dolly Varden*—June 19 to July 16; Height foliage 30; Bloom 40.
- Thereon*—June 18 to July 1; Height foliage 22; Bloom 30.
- Victory Taierchwang*—June 18 to July 12; Height foliage 20; Bloom 28.
- Taruga*—June 18 to July 6; Height foliage 18; Bloom 28.
- Ophir*—June 19 to July 4; Height foliage 24; Bloom 26.
- B. H. Farr*—June 19 to July 4; Height foliage 24; Bloom 26.
- Royalty*—June 19 to July 12; Height foliage 23; Bloom 33.
- Port*—June 20 to July 6; Height foliage 22; Bloom 27.
- Hyperion*—July 1 to July 24; Height foliage 30; Bloom 34.
- Wolof*—July 2 to July 27; Height foliage 23; Bloom 36.
- Russel Wolfe*—July 2 to July 27; Height foliage 23; Bloom 42.

Summer Eve—July 5 to July 27; Height foliage 20; Bloom 28.

Morocco Red—July 5 to July 28; Height foliage 26; Bloom 36.

Honey Red Head—July 5 to July 20; Height foliage Plant too small to be fair specimen.

Elaine—July 5 to July 24; Height foliage 24; Bloom 34.

Matador—July 5 to July 30; Height foliage 24; Bloom 42.

Pink Charm—July 9 to August 3; Height foliage 33; Bloom 46.

Cressida—July 9 to July 27; Height foliage 23; Bloom 30.

Georgia—July 13 to July 30; Height foliage 24; Bloom 33.

Red Gem—July 13 to July 28; Height foliage 21; Bloom 35.

Joy Russell—July 14 to August 1; Height foliage 15; Bloom 36.

Golden Fleece—July 14 to August 13.

Dorothy McDade—July 4 to August 9; Height foliage 25; Bloom 36.

Hankow—July 16 to estimated September 5; Height foliage 24; Bloom 36.

Chengtu—July 19 to August 24; Height foliage 20; Bloom 42.

Boutonniere—July 26 to September 1; Height foliage 21; Bloom 38.

August Pioneer—July 19 to September 10; Height foliage 20; Bloom 46.

Autumn Prince—August 6 to September 20; Height foliage 2; Bloom 43.

DAYLILY TRIALS IN NORTH CAROLINA, 1947

ELIZABETH LAWRENCE, *North Carolina*

The two daylilies that died out of the twenty-nine that Dr. Traub sent me for trial in March 1944, were replaced in August 1945. Both are vigorous plants now, so their death must have been accidental, and not due to the effect of the southern climate. Two others, *Dr. Hughes* and *Berwyn*, were added in August 1945. This year some of these daylilies bloomed for the fourth time.

With the exception of the very early ones, like *Dr. Regel*, which were very poor, this has been the best season that I have ever known for daylilies. It has been a late season and a cool one with plenty of rain. In cool (not too cold however) damp weather daylilies are at their best. They are said to stand heat and drought better than other perennials, and this is true, but they are at their best only when they have an abundance of moisture. I was amazed this summer to find how much larger and taller *Hyperion* was in the damp borders of the garden at Longview (in North Hampton County) than in my garden where it is in a very dry place.

The daylilies on trial were in a part of the garden that is usually moist, but I kept them watered in dry weather, and mulched them with cow manure and leaf mould after their bloom was over. They are in afternoon shade. The ones that have done the best as to bloom are *Reba Cooper*, *Queen Wilhelmina*, *Victory Taierhchwang* and *Carnival*, with an increase of from eight to ten stalks last year, to fifteen to seven-

teen this year. And *John Blaser* increased from three stalks last year to twelve stalks this year. I do not know whether it is the late season or the increase in the length of the time in bloom, but last year none of these daylilies was in bloom in August, and only *Queen Wilhelmina* at the end of July, while this year, on July twenty sixth, *Carnival*, *Golden Glow*, *Mayor Starzynski*, *Fred Howard*, and *Elaine* are in bloom as well. *Elaine* will bloom well into August, and there is a reapeat coming on *Rouge Vermillion*.

This year all of Dr. Traubs daylilies began to bloom between May the twenty first (first bloom of *Victory Montevideo*) and June the twentieth (first bloom of *Berwyn*). This year's dates for the first bloom of some of the others will give an idea of the season.

<i>Mikado</i>	May 29	<i>Margaret Perry</i>	June 20
<i>Amaryllis</i>	June 1	<i>Hyperion</i>	June 29
<i>Goldeni</i>	June 4	<i>Chengtu</i>	July 8
<i>Golden Dream</i>	June 18	<i>Boutonniere</i>	July 18

To me the most outstanding daylily in this group is *Berwyn*. It is one of the clearest and most sparkling reds that I have seen in any daylily, a color a little deeper than scarlet. The flowers open wide (which always seems to me more effective), are of medium size, and there are up to eighteen on a stalk. In this its second season it produced four stalks and was in bloom for thirty days.

Peony Red is a daylily with flowers of an unusual color, but a weak constitution. It has never had but one flower stalk in a season, and there are few flowers to the stalk. However Isabelle Henderson reports that a small root I gave her bloomed the first season (but spent the winter under glass) and produced four stalks the second season, with a more vigorous growth than that of the original clump.

A few plants, like a few people, have all of the dependable qualities and beauty beside. *Carnival* is one of these. I know of no plant in the garden that has made a better show. This year it produced seventeen fine stiff stalks which remained in bloom from mid-June until the end of July. It happened to be against a background of cosmos "Orange Flare" which seemed to bring out the brilliance of the glowing Nopal Red flowers with their golden throats.

Elaine, now in its second year, though it has only three stalks has been in bloom since June second, and will bloom well into August. The flowers are very large, to five inches long, and of a clear salmon that is not to be found in Ridgway. The petals curl at the edges. The throat is restricted. This last may not be a fault, but it seems to me that wide open flowers are more effective. However, for variety's sake we should have many different shapes, including the *Elaine type*.

Dr. Hughes bloomed this year for the first time, and bloomed twice; from May the twenty ninth to late June, and from July thirteenth to the twenty-second. There were four stalks with as many as fifteen flowers to the stalk, the stalks twenty-six inches tall. The flowers are neither large nor of an unusual color (they are deep chrome with a fulvous dust) but I can see that it may be a good garden perennial.

TABLE 1. Daylily performance records, 1944-1947

Year planted	Name of clone	Height	No. Flowers of per stalks stalk		Blooming season	Days in bloom
Spr. '44	Victory Montevideo	28"	6	11	May 13 to July	48
" "	Emberglow	36"	8	16	May 25 to Jne. 20	26
" "	Mayor Starzynski	50"	13	28	May 25 to Jul. 16	53
" "	Indian Chief	50"	4	18	May 27 to Jne. 23	27
" "	Lidice	36"	7	58	May 29 to Jne. 30	33
" "	Reba Cooper	50"	17	14	May 29 into July	40
" "	Mildred Orpet	45"	(no records taken)			First bloom May 30
" "	Fred Howard	36"	8	17	May 26 to Jul. 30 (again in Aug.)	35
" "	La Tulipe	med.	4	28	June 2 to Jul. 8	36
" "	Peony Red	30"	(plant divided)			May 30 to Jne. 20
Aug. '45	Dr. Hughes	26"	4	15	May 29 to late Jne.	28
Spr. '44	Theodore Mead	28"	7	7	May 27 to Jne. 30	35
" "	George Kelso	60"	13	many	May 29 to Jne. 20	22
" "	San Juan	45"	4	13	Jne. 2 to Jul. 19	47
" "	Queen Wilhelmina	45"	15	28	Jne. 5 to Jul. 30	55
" "	Granada	48"	5	38	Jne. 5 to Jul. 5	30
" "	Dr. Stout	42"	10	28	Jne. 5 to Jul. 15	40
" "	Victory Taierhchwang	42"	16	33	Jne. 10 to Jul. 8	28
" "	Golden Glow	36"	5	17	Jne. 7 to 20; Jul. 14 to 25	24
" "	Carnival	40"	17	23	Jne. 14 to Jul. 30	46
" "	Elaine	28"	3	15	Jne. 2 to Jul.; Aug.	28+
" "	Wekiwa	44"	7	(no record)	Jne. 5 to 30	25
" "	Fire Red	36"	2	13	Jne. 16 to 30	14
" "	Corinne Robinson	40"	3	18	Jne. 8 to 26	18
" "	Helen Wheeler	44"	3	34	Jne. 14 to Jul. 13	29
" "	John Blaser	42"	12	20	Jne. 7 to Jul. 20 (cut flowers)	43
" "	Rouge Vermilion	32"	3	14	Jne. 15 to Jul. 12; Aug.	27+
" "	Duchess of Windsor	32"	9	10	Jne. 14 to Jul. 6; Late Jul.	22+
" "	Russell Wolfe	63"	4	many	Jne. 15 to Jul. 20	25
Aug. '45	Berwyn	32"	4	18	Jne. 20 to Jul. 20	30
Spr. '44	Monterey (No. 704)	36"	(no records)			

John Blaser is a rather late blooming clone with very stiff straight stalks, twelve of them the second year. The flowers are light cadmium (Ridgway), the petals are narrow with edges curled and crimped. It is noted from Dr. Traub's report that this is a cut-flower selection, and next season it will be tested from that standpoint.

Rouge Vermilion is a striking color, between English and Carnelian Red. It is not a vigorous grower, but has good straight stalks. I regard stiff stalks as one of the best points in a daylily. No matter how beautiful the flower is, you cannot appreciate it if the stalks are leaning over into the foliage.

Baker Wynne, who has also been trying Dr. Traub's seedlings, rates *Dr. Stout* as one of the finest. It is tall and floriferous with large tawny flowers on stiff well-branched stems. The flowers are covered with a fulvous dust. The season is about three weeks.

Duchess of Windsor is rather low growing, with stems less than three feet tall. The flowers are amber with a deeper throat and a faint halo. They are very fragrant. The petals are of a thick texture and very wide. It is slow to increase, but not weak in growth. The first year it bloomed on May ninth, but that does not seem to be characteristic, for it has bloomed in the middle of June for the last two years.

George Kelso is one of the tallest, with stalks five feet high, and

large bicolor flowers of strongly contrasting colors. It blooms freely for a period of three weeks.

Helen Wheeler has been described as slow of increase, but it has made a good growth for the two years that I have had it, and produced three sturdy stalks the second season. The stalks are nearly four feet. The flowers are Ridgways ferruginous. They are wide open with much recurved petals.

Corinne Robinson is not a strong grower with me. Perhaps this is the fault of the situation, which is at the dry end of the row, but at any rate it has not done well. The very fragrant flowers are lemon chrome. They appear from the middle to the end of June. [Editorial note—This may be misnamed. *Corinne Robinson* is a pastel pink.]

Reba Cooper is one of the most vigorous and floriferous of all. It is an early one, commencing to bloom by the middle or end of May, and lasting until late in June. The flaring flowers are of ochraceous salmon with a faint halo of dragon's-blood red.

A number of these clones have proliferations on the stalks. Isabelle Henderson has planted some of these. She says that the first year they make miniature clumps with several small fans instead of a single large one, with flowers about half the normal size. The second blooming is usually normal.

Addendum, August 7, 1947: The last bloom appeared on *Fred Howard* to-day; the first bloom on it opened on May 26. This is apparently a record for one clone. *Elaine* and *Rouge Vermilion* still have a number of buds.

SUGGESTIONS ON EVALUATION OF DAYLILY CLONES BY AMATEURS

HAMILTON P. TRAUB, *Maryland*

The term, "amateur", in the sense in which it is used here refers to one who is attached to or cultivates a particular pursuit, as for instance, the growing or breeding of daylilies, for amusement or personal gratification without pursuing it professionally as a means of livelihood or for gain. It is natural therefore that the number of amateur daylily growers will always very greatly outnumber the professionals. The term "amateur" is often confused with "novice". A novice, in this connection, is a beginner, and therefore both the amateur and the professional may be novices. As they acquire more experience they graduate into the class of advanced or experienced amateurs and professionals, as the case may be.

Over 3,000 daylily clones have now been described. Many of these are already in the discard, but the amateur is bewildered by the great mass of clones. The number of available clones will always be much greater than the number that he can grow at any one time. He therefore needs to make a selection. In order to develop critical judgement of daylily clones in the amateur, it would be worth while to encourage him to evaluate systematically the clones that he is growing. Such

critical judgment can be acquired by (a) accurately describing by means of the data card the clones grown, and by (b) giving a general rating to each clone under the climatic conditions of the region in which he lives. Such evaluations are of course primarily for his own personal use. With reference to scoring procedure, the amateur could begin with a simple rating method such as is used at present by Mr. Gilmer, and later, if he so desires, he could gradually take up the use of a score card as he gains more experience. Since some clones may rate differently in various climatic regions it should be understood that the ratings as given by any amateur apply only to the conditions under which the clones were tested.

Daylilies may be classified in a number of ways on the basis of (1) the best 15, 25, 50 or 100; (2) actual flowering season under particular climatic conditions; (3) flower color; (4) plant height, (5) foliage character, etc. However, a very complicated rating form, taking too many viewpoints into consideration at one time, is unworkable, and it is desirable, therefore, to base it on as few as possible. It is suggested that the first three viewpoints indicated above be emphasized. Under the first, the amateur grower can use his judgment in giving due weight to most of the other viewpoints in a simple rating system according to a score of fair (F); good (G); or excellent (E), as grown under the particular conditions of his garden, and he can then select the best up to a particular number. Under the second and third viewpoints indicated above, the important considerations of obtaining a long blooming season and having the finest colors in his flowers are given proper weight. *This is therefore a compromise that should serve as a minimum, and the amateur should go as much farther as his inclination and time permit.*

Although the official rating card on page 126, 1940 Herbertia, and as reproduced in the present volume of Herbertia, may be used in making the ratings, numerical ratings from now on should be strictly avoided by individual amateurs so as to preclude any confusion with the official numerical ratings on a regional basis by the Midwest Hemerocallis Society and the American Plant Life Society. The amateur should always use the symbols F, G, and E in place of numerals.

The selection of clones on the basis of color could be left to the amateur within the number of clones rated as best by him. The symbols Y (=yellow); O (=orange); R (=red); and B (=blend or polychrome), etc., could follow the clone name to indicate color as interpreted by the amateur. If he wants to go farther into color classification, he should consult such a system as the simplified color chart published by the New England Gladiolus Society, using the symbols there employed, or the system used by the American Iris Society. Mr. Stuntz is preparing an article showing how this latter system may be adapted for use with *Hemerocallis* but this may not arrive in time for publication in this issue—if it arrives too late it will be included in 1948 Herbertia. If the symbols suggested in the present article are tentatively used, “*Patricia*, (E-Y)” would mean that the clone rates excellent and the general color class is yellow. If the system that Mr. Stuntz presents is followed, the general variation within yellow would also be indicated by appropriate symbols.

SUMMARY FORM FOR SELECTION OF HEMEROCALLIS CLONES BY
AMATEURS

Location of garden: Grower Date

(**Symbols:** Rating of clones—F = **fair**; G = **good**; and E = **excellent**. Color description— Y = yellow; LY = light yellow; O = orange; OR = orange red; R = red; DR = dark red; Pk = pink; B = blend; P = polychrome, etc. For other characters see text.)

EARLY	EARLY MIDSEASON	LATE MIDSEASON	LATE
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I. My 15 best daylilies (On the assumption that I could choose and grow only 15 clones.)

1.	4.	9.	13.
2.	5.	10.	14.
3.	6.	11.	15.
	7.	12.	
	8.		

II. My 25 best daylilies, including those under I (15), above, and the following 10 clones: (On the assumption that I could choose and grow only 25 clones.)

16.	18.	21.	24.
17.	19.	22.	25.
	20.	23.	

III. My 50 best daylilies, including those under I (15), and II (10), above, and the following 25 clones: (On the assumption that I could choose and grow only 50 clones.)

26.	31.	39.	46.
27.	32.	40.	47.
28.	33.	41.	48.
29.	34.	42.	49.
30.	35.	43.	50.
	36.	44.	
	37.	45.	
	38.		

IV. My 100 best daylilies, including those under I (15), II (10) and III (25), above, and the following 50 clones: (On the assumption that I could choose and grow only 100 clones.)

51.	61.	76.	91.
52.	62.	77.	92.
53.	63.	78.	93.
54.	64.	79.	94.
55.	65.	80.	95.
56.	66.	81.	96.
57.	67.	82.	97.
58.	68.	83.	98.
59.	69.	84.	99.
60.	70.	85.	100.
	71.	86.	
	72.	87.	
	73.	88.	
	74.	89.	
	75.	90.	

Note.—Total number of clones by seasons: Early, 20; Early midseason, 31; Late Midseason, 29; and Late, 20.

The full development of the daylily as a garden flower has only begun, and great advances are still awaited. Any evaluations by the amateur should be only tentative and for his personal use, and should be revised annually if necessary as more clones are tested, and as his discrimination develops. The amateur should therefore be always on the outlook for still better clones, but some of the present ones of course that are near perfection, like the *Patricia* Daylily, will be retained permanently. It is realized that at present, especially in the "early" and "late" seasonal classes, there may not be a sufficient number of clones rating "good" or "higher", in fact there may be only a limited number in all, and it may be necessary to include temporarily clones with ratings below "good" as the best now available, but such clones should be replaced by similar ones rating "good" or higher as soon as such are available to the amateur. The choice of clones should not be influenced by price as such, either high or low. The amateur of course grows the clones he can afford to buy, and there are many fine low priced clones. However, if he can afford higher priced ones, then a wider choice is possible.

Although the form to be given below has been devised primarily for amateurs, professionals may also find it convenient to use it. In actual practice, the amateur should first describe the clone according to the data card, and this should be followed by a general overall rating, and by filling in the numbered spaces of the form for his 15, 25, 50 or 100 best clones, depending on the number he grows. First the name of the clone, followed by the name of the originator and year of introduction in parentheses (), then the rating as F, G, or E, as the case may be, and then the symbol or symbols for the general color classification, etc.

It should be noted that the total number of clones by seasons is: "Early", 20; "Early Midseason", 31; "Late Midseason", 29; and "Late", 20. There may not be a sufficient number of clones available to fill in all of the "Early" and "Late" spaces at present, and these should be left blank in order to emphasize the importance of breeding work in these seasonal classes. Most available clones are in the mid-season classes.

In order to illustrate how the form may be used, Miss Kell in Texas and Mr. Claar in Illinois have kindly consented to use the form, indicating their selections as of 1947. These of course are not final and are subject to revision on their part.

DAYLILY SELECTIONS, 1947

ELMER A. CLAAR, *Chairman,*
Hemerocallis Committee,
American Plant Life Society

I received an advance copy of Dr. Traub's article giving suggestions to amateurs about evaluating daylilies together with the request that I fill out the form to include my selections for 1947. This has been one of the most difficult assignments that I have ever had, but it was a stimulating exercise that will sharpen my ideas about the qualities that daylily clones should possess in order to qualify for a place on such a list. My selections for 1947 are given in Table 1, and the following comments apply to the various sections in that table.

My best 15 daylilies. (See Table 1). If I could have only fifteen daylilies, I believe I would select those shown in Table 1, group I. This does not mean that I like these daylilies any better than or as well as some other daylilies that appear in the next groups. In fact, in Group Two, I like *Winsome* better than any other intermediate and *Queen of Gonzalez* has more substance and is a superb flower in its color class, but *Wau-Bun* is lovely and wins the call in the intermediates because it is a recurrent bloomer and blooms in the fall, although it has a weak stem. *Wekiva* also is an excellent daylily and wins because it is a recurrent bloomer.

Among the summer bloomers I was unable to make up my mind between *Mongol* and *Garden Charm*, the latter a newcomer to my garden and a marvelous golden yellow of Mr. Bechtold's. It seems that these two varied from day to day and I just couldn't make up my mind as to which was the better. Sass's *Orange Beauty* also is new to my garden. It has about everything one can ask for in an orange daylily. I think it is Hans Sass's best daylily. Russell's *Meteor* is very similar to Bechtold's *Loveliness*. I put the former in the first group and *Loveliness* in the next group, giving *Meteor* the preference because it is a recurrent bloomer. *Trial Blazer*, Russell's dark red is a recurrent bloomer, being even better in the fall than in the summer.

My best 25 daylilies. (See Table 1.) The selection of the first fifteen presented this problem: pink, raspberry and maroon daylilies have not been included in the first group although they are different types and very nice. I have put them in the second group because I have seen a number of seedlings that are coming on in these color classes which I think are superior to the present named varieties. As far as introduced varieties are concerned, there is no reason why they should not be in the first group except that it is limited to fifteen.

My best 50 daylilies. (See Table 1.) In the third group, of twenty-five plus the 25 already considered, two of the varieties might need an explanation.

Calypso is a night bloomer, and as it bloomed for me it was a particularly lovely plant both during the day and at night, comparing favorably with anything else in the garden at the time.

Perry's *J. S. Gaynor* is about all that you could ask in a beautiful flower and a fine plant. It has been extensively used in hybridizing by a number of individuals working on daylilies.

Even in the third group of twenty-five plus 25 already considered, there are a number of color classes that could be included among the best.

Table 1. Ninety-eight best daylilies, selected by Elmer A. Claar, as of September 1947.

(Symbols used to indicate approximate color values—Y = yellow; LY = light yellow; O = orange; OR = orange red; Pk = pink (so-called); R = red; DR = dark red; Pur = purple; Br = brown; Ed = eyed; P = polychrome; Bi = bicolor.)

EARLY	MID-SEASON	LATE
I. My best 15 daylilies.		
1. Flavinia (Y)	(EARLY MIDSEASON)	9. Ruby Supreme (OR) 15. Far North (LY)
	2. Wau-Bun (LY)	10. Trail Blazer (R)
	3. Wekiwa (R)	11. Potentate (Pur)
	MIDSEASON (SUMMER)	12. Painted Lady (P)
	4. Vespers (LY)	13. Meteor (Ed)
	5. Hesperus (LY)	14. Garden Charm (Y)
	6. Mongol (Y)	
	7. Orange Beauty (O)	
	8. Royal Ruby (OR)	
II. My best 25 daylilies, including those under I(15), above, and the following 10 clones:		
16. Earliana (Y)	(EARLY MIDSEASON)	21. Sweet Briar (Pk)
	17. Winsome (LY)	22. Piquante (R)
	18. Queen of Gonzales (O)	23. Dawn Play (LR)
	MIDSEASON (SUMMER)	24. Morocco Red (DR)
	19. Mission Bells (LY)	25. Loviliness (Ed)
	20. Golden West (OY)	
III. My best 50 daylilies, including those under I(15), and II(10), above and the following 25 clones:		
26. Flava (Y)	(EARLY MIDSEASON)	37. J. S. Gaynor (Y) 49. Dorothy McDade (Y)
27. Judge Orr (O)	28. Little Cherub (LY)	38. Golden West (OY) 50. Hankow (Ed)
	29. Sungold (Y)	39. Debutante (Bi)
	30. Gloryanna (Y)	40. Bold Courtier (Bi)
	31. Symphony (Bi)	41. Blood Root (OR)
	32. Zouave (Bi)	42. Tejas (R)
	33. Dominion (P)	43. Honey Redhead (P)
	34. Brunette (Br)	44. Dr. Stout (P)
	MIDSEASON (SUMMER)	45. Enchantress (P)
	35. Canari (LY)	46. Afterglow (P)
	36. Calypso (Y)	47. Taruga (P)
		48. Black Falcon (Pur)

IV. My best 98 daylilies, including those under I(15), II(10) and III(25), above, and the following clones:

51. Apricot (LY)	(EARLY MIDSEASON)	73. Royalty (R)	98. Autumn Prince (Y)
52. Estmere (Y)		74. Sachem (R)	
53. Queen of May (OY)		75. Port (R)	
54. Chrome Orange (O)		76. Seminole Chief (R)	
	MIDSEASON (SUMMER)	77. Minnie (R)	
55. Moonbeam (Y)		78. Kanapaha (R)	
56. Ophir (Y)		79. Craemore Ruby (R)	
57. Doeskin (Y)		80. Black Prince	
58. Hyperion (Y)		81. Purple & Gold (R)	
59. Lady Hesketh (Y)		82. Wolof (R)	
60. Patricia (Y)		83. Petra (R)	
61. Mrs. B. F. Bonner (Y)		84. Afterglow (P)	
62. Princess (Y)		85. Salmon Rose (P)	
63. Circe (Y)		86. Linda (P)	
64. Yeldrin (Y)		87. George Yeld (P)	
65. Lidice (O)		88. Brackel (P)	
66. Irene (O)		89. Tracery (Ed)	
67. Majestic (O)		90. Festival (Ed)	
68. Golden Dream (O)		91. Mrs. John Tigert (Ed)	
69. Georgia (Pk)		92. Mikado (Ed)	
70. Pink Charm (Pk)		93. Su-Lin (Bi)	
71. Pink Lustre (Pk)		94. Betty Slick (Bi)	
72. Rosalind (Pk)		95. Cabellero (Bi)	
		96. Athlone (Bi)	
		97. Garden Lady (Bi)	

For example, I have included *Black Falcon*, *Debutante* and *Bold Courier* because these plants are among the finest blooms that we have of their particular types. It shows how difficult it is to select any fifteen, twenty-five or fifty plants.

My best ninety-eight daylilies. (See Table 1.) When we come to the fourth group of forty-eight, plus the 50 already considered, we have our most difficult problem. For example, in the bicolors, I do not know of anything better than *Su-Lin* in the pastels, and *Betty Slick*, *Athlone* and *Garden Lady* certainly are tops.

It is doubtful, in my opinion, if we have any real pinks among the introduced varieties at the present time—they merely simulate pink. By pink I mean the pink of *Dianthus*. From the seedlings I have seen, we can expect a great improvement in this color class in the near future.

The appalling thing about a list of this kind is that it obviously can be only my personal preference, and this is so unstable that I imagine if you were to meet me and discuss the matter with me you might persuade me to substitute a number of other varieties for those I have selected in these various classes. When I look through my list of daylilies, I am dismayed by the number of fine things I have left out.

A number of Mr. Bechtold's plants did not bloom for me this year. I have just received ten plants from Mr. Henry Sass, which, naturally,

I have not seen in bloom. I have all the plants in Mrs. Nesmith's last year's catalog, plus some from the year before. Only a few of them bloomed but among the most impressive was *Far North*, which was very big and very late. I also liked *Tracery* very much. I planted *Cantabile* from Kellogg's Over-the-Garden-Wall but have not seen it bloom as yet.

This list does not include a number of plants which I acquired from Mrs. Nesmith, Mrs. Bright Taylor, Messrs. Hans Sass, Henry Sass, Paul Cook, LeMoine Bechtold, Kellogg's Over-the-Garden-Wall, Stout's introductions of last year, Clint McDade's plants, and others which have not bloomed typically for me, so I cannot report on them.

Even then, as I look over my list of those that bloomed for me, I feel that this list is merely suggestive and is done as well as I can do it at this time. I believe all of these are worth growing.

DAYLILY TRIALS IN NORTHWEST TEXAS

WILLIE MAY KELL, *Texas*

The first daylily to start the season is *Orangeman*. While it is an old one, it flowers so early in the spring and repeats for even a longer period in the fall. It has flowered from September 5th to the 20th of November. *Dumortieri*, *Middendorfi*, and *Minor* are all early dwarfs coming right along next to *Orangeman*. These three are old and are completely deciduous, but there are none to take their place. *Apricot* is said to be an improvement but is difficult to distinguish from *Dumortieri*.

Another quite early one, though not a dwarf, is *Buckeye*, a distinctive flower. *Zouave* comes about two weeks after these earliest ones, and then blooms again in the fall. It is a choice and beautiful creation. It often has as many as four blooms open at one time on one scape, not just in one cluster at the top but spaced on short branches along the main stem, making it a beautiful show for arranging as a cut flower. *Earliana*, a semi-dwarf, blooms early and repeats in the fall. *Duncan* is the earliest of the real reds, as it has flowered the 3rd or 4th of May for three successive springs. It is an ox-blood red with a velvety appearance and a diameter of five and three-fourth inches, wide-spread, with sepals curling back, throat of Indian yellow. It flowered for thirty three days. *Gloriana* and *Queen of May* are two early yellows which bloom again in the fall. That is one *Queen of May* does flower again in the fall but a second plant from another dealer does not bloom early nor does it repeat in the fall. *Victory Montevideo*, a garnet brown, blooms from the middle of May until the second week in June.

Cressida, *Florham*, *Thumbergi*, *Lemona* and *Lemon King* are now so outclassed by the new ones, they are no longer worth keeping.

In the old yellows, *The Gem*, *Dr. Regel*, *Mrs. J. R. Mann*, *Flava major* and *minor*, and *Amaryllis* (= a daylily clone) are very much the same yellow and flower along together. *Flava major* is the best of the group, a strong grower, and does not burn as much in the sun.

Amaryllis (= a daylily clone) is a very free bloomer, and seeds easily and robustly.

Mandarin, *Lady Esther*, *Yellow Hammer*, *Golden Dream*, *Gold Standard*, *Harvest Moon*, were appreciated when first obtained but are now passed by for better ones. *J. A. Crawford* and *Ophir* are two still favored. *Calypso*, blooming at night, still holds a place not taken in Dresden

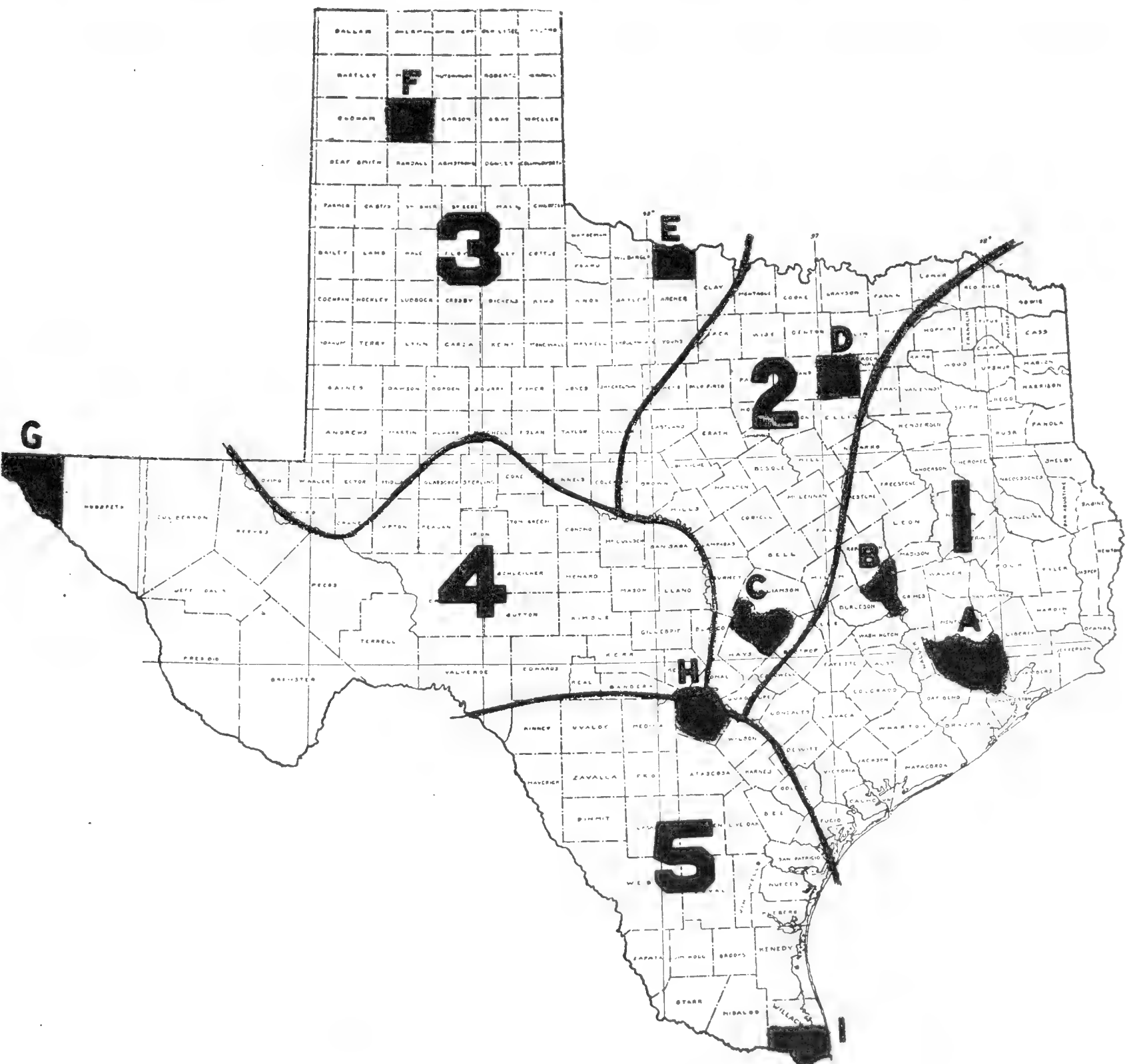


Fig. 178. **Outline Map of Texas**, showing climatic regions from the standpoint of *Hemerocallis* culture: 1. **East Texas**, shaded area A, Harris County, incl. City of Houston; shaded area B, Brazos County, incl. Main Station of Texas A. & M. College; 2. **Central Texas**, shaded area C, Travis County, incl. City of Austin; shaded area D, Dallas County, incl. City of Dallas; 3. **Northwest Texas**, shaded area E, Wichita County, where Miss Willie May Kell's garden is located; shaded area F, Potter County, incl. City of Amarillo; 4. **West Texas**, shaded area G, El Paso County, incl. City of El Paso; 5. **South Texas**, shaded area H, Bexar County, incl. City of San Antonio; and shaded area I, Cameron County, incl. City of Brownsville.

yellow. *Harvest Moon* blooms at night and *Lady Esther* holds open at night. *Golden West* is a tall, large-flowered, beautiful yellow, a strong grower. *Taruga* and *Star of Gold*, while spidery in form, are large-flowered, light yellows which are especially beautiful with white lilies. *Monarch*, *Soudan*, *Modesty*, *Dorothy McDade*, *J. S. Gaynor*, and *Singa-*

pore are desirable light yellows. But the choice of all light yellows in form and color is *Patricia*. It has a perfection of form and substance comparable to a true lily. The average gardener prefers *Hyperion* but it is given second place after *Patricia*. *Princess* is a good light yellow but is a slow grower and requires better growing conditions than the average to keep its flower up to the size it should be. *Waubun* is a good lemon yellow blooming the middle of May, two weeks ahead of the average. *Moonbeam* and *Sunny West* are choice night bloomers. *Hesperus*, and *White Lady* are good light yellows and so are *Sir Michael Foster* and *Pale Moon*. But *Pale Moon* together with *Anna Betscher* and *Thelma Perry* disappear in Winter.

Duchess of Windsor, a Barium Yellow with a very soft halo is a beautiful flower in size, form, and color and lasts through the night. *Dauntless*, a Chrome Yellow, with a slight halo is a good flower which remains open at night, but it is another which completely disappears in winter. *Ralph Wheeler* is a Canary Yellow with a slight halo but it is a slow grower, not too robust, and the substance is so thin, the sun and wind burn it badly.

Goldeni and *Orange King* are both Cadum Orange and very similar. This is a difficult shade to use with the average flowers so, with the choice of many new ones, are out classed, as are *Chrome Orange*, *Emily Hume* and *Dondald Wyman*.

Nebraska, a large flower, is in a distinctive class of yellow as it is Saffron. It has good form and is a strong grower. But *The Swan* is also a Saffron and a larger, bolder flower. *George Yeld* is a shade darker than Saffron but blends with these two.

Lady Hesketh, *Bardeley*, *Sunset*, and *Lady Byng* are no longer of interest, nor are *Dawn* and *Bay State*.

Fulva Europa, *Rosea*, and *Maculata*, *Margaret Perry*, *Hankow*, *Chengtun* are all so invasive that, unless one has plenty of space to use them far from any other daylilies, they should not be used as it is difficult to keep them in their proper place. They crowd out less robust varieties. This is true of *Kwanso* and *Flore pleno*, also.

Marcelle and *Aristocrat* are both choice flowers, larger than the average and with distinct individuality. *Confucius*, *Elizabeth Wheeler* and one, not true to the name under which it was sold, are tall growing, brilliant daylilies. *Elizabeth Wheeler* has a scape of 54 inches. *Confucius* and the mis-named one have a diameter of six inches.

Antoinette, *Granada*, *Mayor Starzynski* and *Dr. Stout* make a striking combination. *Bagdad* harmonizes in color with these but has such a small flower it is usually used with *Bijou* and *Boutonniere* as all three are small flowered and blend well.

Talisman, *Dolly Varden*, *Bertrand Farr*, *Corinne Robinson* and *Elaine* are a nearer approach to pink than any previously obtained. *Bertrand Farr* is larger and better than *Dolly Varden*, but *Talisman* is a better shade than *Bertrand Farr*. *Elaine* was said to be a weak grower. While it is slow, it is not weak. The flower is choice in form and color and has strong substance.

When *Theron* first flowered, one realized what great progress had

been reached in hybridizing daylilies. It is still very choice and desirable. It is a strong fall bloomer. But *Amherst* now surpasses it. *Amherst* has a flower five inches in diameter to *Theron's* four inches. Both are purple madder but the Chinese Yellow throat of *Amherst* is less prominent than the larger area of Aureolin in *Theron*. Then the petals of *Amherst* are not twisted, making for a showier flower.

Afterglow is still alone in its color class, a lovely soft salmon, with an apricot throat. Although it is a weak, slow grower, and required the third plant before it was established, it is well worth the effort. It is not a large flower but has a good form. *Baronet* is another which should be in every collection as it is almost equal to the old monthly blooming rose with its repeated flowering periods, starting in the third week in May and only ending with the first hard freeze of December.

There are five daylilies so unusual in coloring that the color charts have no shades near enough to satisfy. All are beautiful and distinctive. *Victoria*, *Hazel Sawyer* and *Paul Ihrig* make a charming arrangement. *La Tulipe* and *Peony Red* make a striking contrast.

Toreador is a much larger and improved *Rosalind*. Still on trial are *Craemore Henna*, *Craemore Ruby*, *Dawn Play*, *Milady*, *Sweet Briar*, *Clarion*, *Carnival* and *General MacArthur*. Dr. Leonian hybrids may be of value for hybridizing but not for cut flowers.

Berwyn and *Luridum* are two good cardinal reds. *Port*, a blood-red, small flower, when produced was most welcomed but now has been surpassed by *Ming Toy*. *Ming Toy* was classed in a semi-dwarf but with a scape seven inches shorter than *Port* merits the dwarf class. Its flower is slightly larger than *Port*. One reason for this is it is so wide spread. *Ming Toy* is a beautiful velvety red which resists the burning Texas sun, is a robust, vigorous grower and flowered for three weeks although it was only planted in February of 1946. While *Tom Thumb* planted alongside at the same time has barely lived.

Rajah, *Fire Red*, and *Mrs. John Tigert* are yellow reds but all have prominent, rich red eye zones which blend with the deeper reds. Beautiful, choice reds, good growers, in many shades of red, from the lighter to deep, velvety reds, shades which do not have a proper place in the color charts, are—*Charleen*, *Amazon*, *Dominion*, *Red Bird*, *Sachem*, *Wekiwa*, *Tahiti Belle*, *Victory Taierhchwang*, *Ruby Supreme*, *Brackel*, *Wolof*, *San Juan* and *Vulcan*.

Mikado is distinctive and repeats in the fall and sometimes in between with as large and fine a flower as in the flush of spring bloom. *George Kelso* is the earliest pastel, a good flower, and a strong grower. *Lady Franklin* and *Pink Lustre* combine well although *Lady Franklin* is superior in form and color. *Reba Cooper* and *Linda* are both choice flowers. *Byng of Vimy*, while too spidery in form, is still a lovely pastel which has not been duplicated, having petals of lightest Spanish orange with sepals of apricot.

Kanapaha, *Empress*, *Indian Chief*, and *Rosita* did not live. But two only planted last fall, give promise of being strong growers with choice flowers—*Rose Gem* and *Georgia*. *Royal Lady* is a beautiful new one, a maroon with throat and midrib of mimosa yellow. The petals

are twisted and the sepals curl back, making it a wide spread, striking flower. It has heavy substance.

The newer daylilies appear to suffer from the heat and drought of this semi-arid climate (Fig. 178). Two planted in 1941 and well established, died during the summer of 1946 when they were not well watered. And they certainly require good, fertile soil, refusing to take the poor conditions under which the old ones have endured and multiplied, almost too vigorously sometimes for more delicate plants near them. During the worst freeze remembered by the oldest settlers this January, not a single daylily was lost. December planted ones take a good hold and grow vigorously, but those attempted in May suffer so from summer heat and drought that, if they live, remain weak for a long time. October planted ones take hold and grow the best of all, but this is also especially true of iris. Many varieties begin to close as the light of day begins to lessen, but some stay open through the night.

MY BEST 50 DAYLILIES AS OF 1947

[After the above article was written, Dr. Traub sent me an advance copy of his article, suggesting that I list my best 50 daylilies according to the plan outlined. The abbreviations used are: RATINGS—F = **Fair**; G = **Good**; E = **Excellent**; COLORS—Y = yellow; O = orange; R = red; and B = blend or polychrome; STATURE—Df = dwarf; SDf = semi-dwarf; SRb = semi-robust; Rb = robust; and Gt = giant.]

EARLY	EARLY-MIDSEASON	LATE-MIDSEASON	LATE
1. Orangeman (F; O; SRb)	5. Amherst (G; R; SRb)	40. Dorothy McDade (F; Y; Rb)	50. Autumn Red (G; R; SRb)
2. Duncan (G; R; Rb)	6. Afterglow (F; B; SDf)	41. Hyperion (G; Y; Rb)	
3. Victory Montevideo (G; R; Rb)	7. Amazon (G; R; SRb)	42. Nebraska (F; Y; Rb)	
4. Zouave (G; B; Rb)	8. Antoinette (G; B; Rb)	43. Port (G; R; SDf)	
	9. Baronet (G; B; Rb)	44. Pink Lustre (G; B; Rb)	
	10. Bertrand Farr (G; B; Rb)	45. Red Bird (G; R; Rb)	
	11. Brackel (G; R; Rb)	46. The Swan (F; Y; SRb)	
	12. Confucius (G; B; Rb)	47. Victoria (F; B; SRb)	
	13. Charleen (G; R; SRb)	48. Wekiwa (G; R; Rb)	
	14. Duchess of Windsor (E; Y; Rb)	49. Wolof (G; R; Rb)	
	15. Dominion (G; R; Rb)		
	16. Dr. Stout (E; B; Rb)		
	17. Elaine (G; B; SRb)		
	18. Elizabeth Wheeler (G; R; Gt)		
	19. George Kelso (G; B; Rb)		

[EARLY-MIDSEASON; Continued from page 66.]

20. **Granada** (G; B;
Rb)
21. **Golden West** (F;
Y; Gt)
22. **Hazel Sawyer** (G;
B; SRb)
23. **La Tulipe** (G; R;
Rb)
24. **Lady Franklin**
(G; R; Rb)
25. **Marcelle** (E; O;
Rb)
26. **Mikado** (F; O;
Rb)
27. **Ming Toy** (E; R;
SDf)
28. **Mayor Starzynski**
(G; B; SRb)
29. **Patricia** (E; Y;
Rb)
30. **Paul Ihrig** (G; B;
SRb)
31. **Peony Red** (G; R;
Rb)
32. **Reba Cooper** (G;
B; SRb)
33. **Ruby Supreme**
(G; R; Rb)
34. **Sachem** (G; R;
Rb)
35. **San Juan** (G; R;
Rb)
36. **Tahiti Belle** (G;
R; Rb)
37. **Taruga** (F; Y;
Rb)
38. **Theron** (G; R;
SRb)
39. **Talisman** (G; B;
Rb)

New Clones under Trial. Blanche Hooker; August Orange; Bobolink; Caprice; Fantasia; Judge Orr; Rose Gem; Georgia Sibyl; Spitfire; Cecil Houdyshel; Adventure; Berwyn; Rouge Vermilion; Scarlet Sunset; Haile Selassie; Tom Thumb; H. gracilis; Bolivar; McDades Pastel; Royal Lady; Mignon; Craemore Henna; Craemore Ruby; Dawn Play; Milady, Sweet Briar; Clarion; Carnival; General MacArthur.

Clones are not rated until the plants are well established since it would be obviously unfair to do so when it is well known that in most cases typical flowers are not produced for the first year or two after plants are set out. The fact that a clone does not do well in Northwest Texas however, is no criterion as to its performance in another climatic region. All tests point to the fact that recommendations of daylilies must be on a regional basis since apparently many clones do well in one region and not as well in another. It is therefore obvious that a list of discards is out of order for it would be valid only under the conditions of the trials and might confuse those growing the same clones elsewhere.

DAYLILY CHOICES

J. B. S. NORTON, *Maryland*

How could one select only one daylily if that was all he could have. Well, I had a hard time to do it but finally picked *Semperflorens*. I could not find anything wrong with it, and it blooms for a long time in late spring when few others are in flower and often looks better still in the fall.

For only five, *Semperflorens* is selected for May and June, *Mikado* for June and July, *Patricia* for July, *Colonel Besley* for August, and *Duchess of Windsor*, extra, for the blooming peak.

To make 10 the following five are added just for their beauty: *Bertrand Farr*, *Caballero*, *Garden Lady*, *George Kelso*, and *Baronet*.

For 25 we can spread out a little and include 15 more beauties: *Mongol* for its very large clear yellow, *Ophir*, a large lily-form yellow, *Seminole Chief*, my best red, *Ortencia* for its artistic form, *Ruby Supreme* for a large bold red, *Black Prince* for the best form in very dark, *Dauntless*, almost a twin for the *Duchess of Windsor*, but taller, *Afterglow*, exquisite and unusual color, *H. aurantiaca major*, unusual form and size (hope it stands the winter), *Bicolor*, a flock of rose and yellow butterflies, *Clarion*, rosiest of the "roseas", *Joanna Hutchins*, very fine orange, *Linda*, pattern of beauty, *Mildred Orpet*, delicate lady, *Enchantress*, blush on cream, *Variegated Kwanso* for its white striped leaves.

The next 25 of superior kinds gives us 50: *Damosel*, pinkest, *Rajah*, eyed red, *Redbird*, brilliant rosy red, *Theron*, dark purple brown, *Gypsy Lass*, blending of orange tones, *Hesperus*, great orchid like light yellow, *Aztec Gold*, similar in orange, *Hyperion*, large well formed pale, *Miss Jennie*, soft buff, throat lightly shaded, *Maculata*, large light fulva, *Peony Red*, *Port*, multiflorous small red, *Minnie*, dark velvety red, *Gay Troubadour*, vivacious, *Su-Lin*, delicate pink, *Rosalind*, mother of roses, *Peachtree Beauty*, large pinkish buff, *Modesty*, large pale yellow, *Victory Montevideo*, early red, *Dorothy Dawn*, large creamy pink, *Lidice*, creped orange, *Helen Wheeler*, peachy pink, *Dorothy McDade*, a later *Hyperion*, *Craemore Henna*, unusual red, *Dr. Stout*, orange and fulvous.

Now let's make it 100 by adding these another 50 good ones—at their best fine, or fitting some season with none better: *La Tulipe*, *Dr. Hughes*, *Sister Sallie*, *Richard*, *Wekiwa*, *Gaiety*, *Zouave*, *Havilah*, *Geronimo*, *Swan*, *H. multiflora*, *E. W. Yandre*, *Granada*, *Mayor Starzynski*, *Rosaflare*, *J. A. Crawford*, *Mae*, *WauBun*, *Gloaming*, *Sir Michael Foster*, *Boutonniere*, *Purple Waters*, *Princess*, *Indian Chief*, *Brunette*, *Gypsy*, *Queen of May*, *Elizabeth*, *Bold Commando*, *Aurantiaca*, *Ajax*, *Golden West*, *Apricot*, *Jimmie Junior*, *Aflame*, *Sirius*, *Mary Ellen*, *Mrs. W. H. Wyman*, *H. flava*, *Gracilis*, *May Morn*, *Mrs. J. R. Mann*, *Sovereign*, *Sungold*, *J. S. Gaynor*, *Aladdin*, *Persian Princess*, *Iris Perry*, *Star of Gold*, *Europa*.

Many of the finest clones are omitted because they are not yet named, or because I have not seen them often enough. The above selections are mostly based on daily observations of over 400 named kinds in

my garden. Not all the other 300 plus have been discarded. I could still like thousands of different ones. I see that this list is different from some lists I made last year. I still learn, as Leonardo said when he was 90 years old; at least I am glad I can still change.

ALLIUM TRICOCCUM

HAMILTON P. TRAUB

Plants of *Allium tricoccum* Aiton with almost mature seed capsules attached were kindly sent to the writer on August 15, 1947 by Thomas K. Barrie, Coudersport, Pennsylvania, and reached their destination in perfect condition due to the excellent packing job. Mr. Barrie writes that the bulbs were collected in “not too dense woods, known here as hardwood timber country (beach, birch, maple)..... they grow in..... soil.....covered with about one inch of black woods loam and leaves. They will grow in any fairly heavy garden soil, and in partial shade. I would have been unable to locate these bulbs, only for the seed heads which you will note are still attached, the leaves are gone.”

According to Mr. Barrie, *Allium tricoccum* is known locally as “Potter County Leek”. He offers the following very interesting comments. He states that the “supposition is with the natives here, if one eats a mess of these leeks in the spring, there will be no need to see the doctor for the rest of the year as far as a cold is concerned, and as far as that goes, no doctor would want to go near a person for at least a week after they have been eaten—I believe they have an edge on garlic. I do however eat quite a few each spring myself, and rather like them eaten like spring onions. We have a Grange here, and the members put on a leek supper once each year, and there is quite a turnout at \$1.00 per person. They cook them—in this case the door is as far as I generally go.”

The bulbs with attached seed capsules almost mature were planted and the seeds allowed to mature. It is interesting to note that only a relatively few capsules actually matured three seeds per capsule (one in each locule), as is shown in Table 1.

TABLE 1. *Allium tricoccum* Aiton; typical results: number of seeds matured per capsule, and diameter of seeds; plants collected by Thomas K. Barrie, Coudersport, Penna, 1947.

Umbel number:	Capsule number:	Number of seeds per capsule	Diameter of seeds; mm.	Umbel number:	Capsule number:	Number of seeds per capsule	Diameter of seeds; mm.
1	1	1	3.1	2	1	3	3.1;3.3;3.1
	2	1	3.1		2	2	3.2;3.2
	3	2	3.2;2.9		3	2	3.2;3.1
	4	1	3.1		4	1	2.7
	5	1	3.0		5	1	2.8
	6	2	2.8;3.2		6	2	3.1;3.1
	7	1	2.9		7	2	2.8;2.9
	8	1	3.3		8	2	3.1;2.8
	9	2	2.7;3.2				
	10	2	2.9;3.0				
	11	2	2.8;3.1				
	12	2	3.2;2.7				

Apparently in this case, although the plants were growing in their native habitat, something intervened to greatly reduce the seed set per capsule. What caused this we have no way of knowing. Probably Mr. Barrie will favor us with a report on this in a future issue of HERBERTIA.

It should also be noted (Table 1) that the globose seeds (which are black), vary from 2.7 mm. to 3.3 mm. in diameter. The number of capsules (flowers) varies from 8 to 12 per umbel.

According to Vvedensky (in *Herbertia* 1944), the sections *Anguinum* G. Don, and *Ophioscordon* (Wallroth) Endl., are both characterized by a 3-seeded capsule with globose seeds, but the rootstock in the former (*Anguinum*) is rhizomatous, whereas the bulb of the latter (*Ophioscordon*) is not rhizomatous. Recently W. T. Stearn (Jour. Roy. Hort. Soc. LXXII, p. 36. 1947) proposed the section *Validallium* (Small) Stearn, syn. genus *Validallium* Small, in Small, Fl. S. E. United States, 264 (1903), Man. S. E. Flora, 289 (1933), to accomodate *Allium tricoccum* on the basis of "its solitary ovules". According to Stearn, *Allium tricoccum* "is much more akin to the Old World species *A. Victorialis* L., of the sect. *Anguinum* G. Don and *A. ursinum* L. of sect. *Ophioscordon* (Wallr) Endl., with which it agrees in being a broad-leaved woodland plant with rounded seeds, but its solitary ovules justify its being placed in a new section." He cites the work of Haynes and Owenbey (*Rhodora* 48: 61-63. 1946) in which "two well-defined ecological races" are distinguished, "the one (a) inhabiting low moist woods and having reddish-petioled elliptic leaves, 4-7 cm. broad and flower-stems 25-34 cm. high, the other (b) inhabiting upland woods and having greenish-petioled lanceolate leaves 1.3-3 cm broad and flower-stems less than 25 cm. high". The form collected by Mr. Barrie apparently should belong to the first mentioned.

STARCH FROM **ALSTROEMERIA**

M. J. COX AND M. M. MACMASTERS

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Most readers of *Herbertia* are familiar with the *Alstroemerias* which are grown in this country only as ornamentals. It is probably not common knowledge that these plants have possible commercial uses because of the starch stored in their tuberous roots. Reichert (1) reported in 1913 that, in Chile, starch from several species of *Alstroemeria* was marketed as *Talcahuano arrowroot*. It is commercially unknown, however, in the United States. Unless this starch should have unusual characteristics which would fit it for special purposes, it could not be expected to compete economically in this country with corn starch.

The present study of *Alstroemeria* starch properties was not, however, undertaken primarily in the hope of finding a commercial outlet for the starch, but rather as part of an investigation designed to obtain fundamental physicochemical information on starches in general.

Our attention was first drawn to *Alstroemeria* starch by the description and photomicrographs of granules from *A. ligtu*, *A. aurantiaca*, and *A. brasiliensis* published by Reichert (loc. cit.). The large compound granules of *A. ligtu*, especially, are very different in appearance from any of the more common starches which have been studied in considerable detail. Since these *Alstroemeria* starch granules have unusual physical characteristics it seemed possible that some of the *Alstroemeria* starches might give pastes with unique properties. For this reason, starch from two available species of *Alstroemeria* was included in a study of the granule and paste characteristics of a number of starches from widely varying sources.

The methods used for characterizing the starch during this investigation have been described in an earlier paper (2).

PREPARATION OF THE STARCH

Starch was separated from the tuberous roots of *A. aurantiaca* and *A. chilensis*, which were obtained through the courtesy of Mr. Harry L. Stinson, Seattle, Washington, in August, 1944. They were processed within three days after their arrival at the Laboratory. For this short period they were stored at 40° F. During the entire cleaning and processing, low temperature was maintained by icing in order to inhibit the action of starch-degrading enzymes which are present in the roots.

Immediately before processing, the roots were cleaned by washing with cold distilled water and small rootlets and decaying pieces were removed. The sound material was rinsed with distilled water and ground through a meat chopper with 3/16-inch plate. Starch was separated from

¹ One of the laboratories of the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

the finely ground pulp by passing a slurry of the ground roots in distilled water over No. 13 standard bolting silk. The starch milk which passed through the silk was centrifuged to separate the starch from the water. The starch was further cleaned by washing several times with distilled water. It was separated from each wash water either by centrifuging or by sedimentation in a tall cylinder. After each centrifuging, the upper layer of cell-wall debris was scraped away from the starch layer.

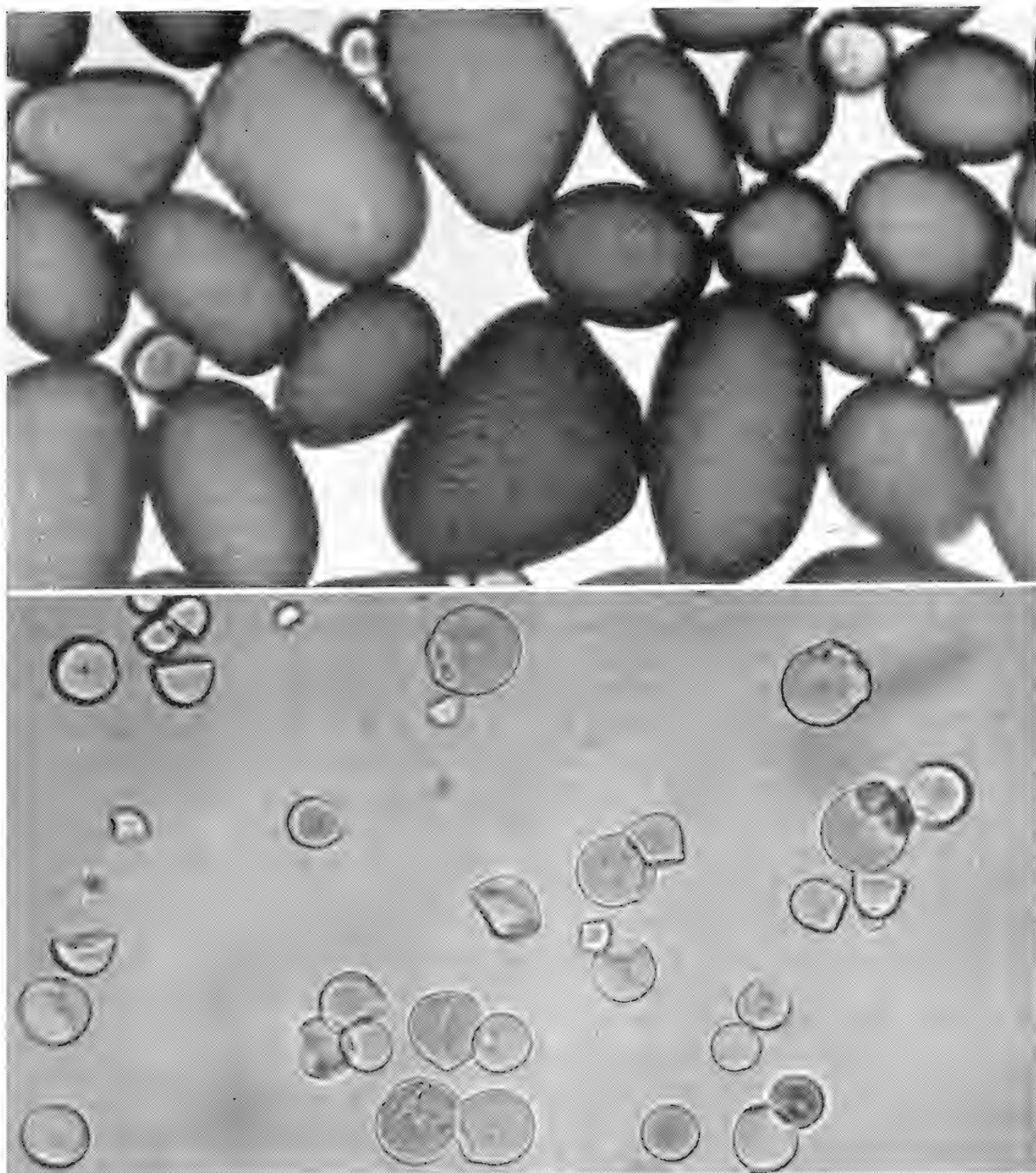


Fig. 179. (Upper) Potato starch granules. (Lower) Tapioca starch granules. Magnification 500x.

The purified starch was dried to a moisture content of about 15 percent in a forced draft oven at 104° F'. Since the methods employed for preparing the starch were the mildest at our disposal, it is felt that the samples obtained were as near native starch as could be prepared.

Yields of 410 gm. and 56 gm. of air-dry starch were obtained from 4700 gm. and 4000 gm. of *A. chilensis* and *A. aurantiaca*, respectively. The yield from *A. chilensis* was about that usually obtained from Katahdin potatoes by the same method.

GRANULE CHARACTERISTICS

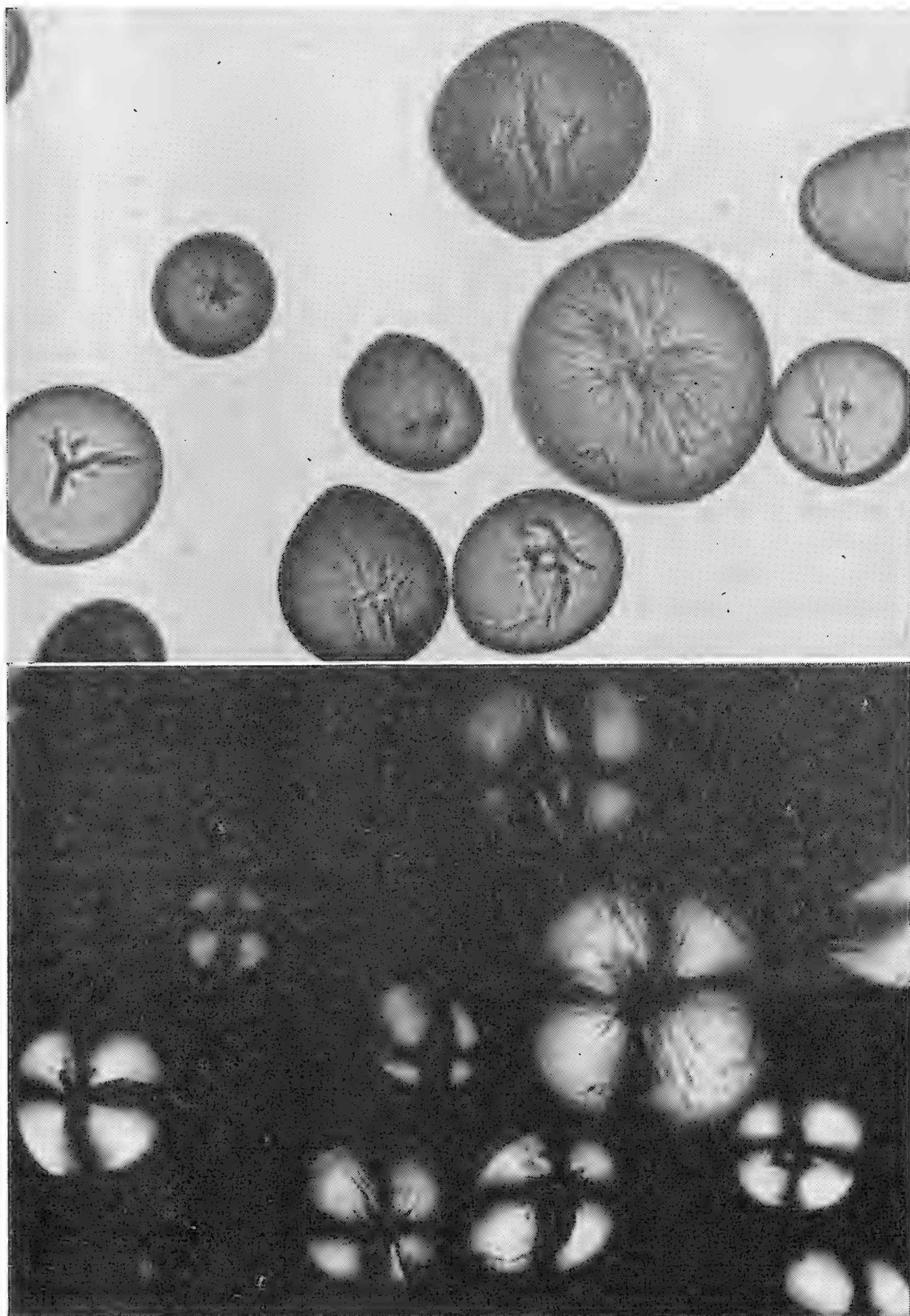
Some species of *Alstroemeria* have simple granules, while in others the granules are compound (Reichert, loc. cit.). Simple ungelatinized granules show one cross each when viewed between crossed Nicol prisms. Nearly all of the granules from *A. aurantiaca* are simple. Their appearance is shown in Plate 305 (upper) and (lower). The uppermost granule in Plate 305 (upper) and (lower) is a compound granule composed of two constituent granules. Each simple granule, whether alone or incorporated as a constituent within a compound granule, has a central "nucleus," called a "hilum," which appears either as a black dot or as a dark star-shaped area with radiating fissures. The intersection of the arms of the cross (Plate 305, lower) occurs at the hilum.

Compound granules of *A. chilensis* are shown in Plate 306 (upper) and (lower). Two to eight constituent granules are closely packed together in each of these. The hila of the constituent granules are so arranged that they form a prominent central pattern in the compound granule (Plate 306, upper). Between crossed Nicol prisms a "laced effect" is observed (Plate 306, lower) due to the intersection, at the hila, of the crosses of the constituent granules. These compound granules of *A. chilensis* look much like those of *A. ligtu* which were described and pictured by Reichert (loc. cit.).

The so-called root starches of commerce, including potato, arrowroot, tapioca and sweet potato starches, consist mostly of simple granules, although double granules occasionally occur. Typical potato and tapioca starch granules are shown in figure 179 (upper) and (lower).

The compound granules of *A. chilensis* are about the same size as the simple granules of *A. aurantiaca*, but somewhat different in shape, as can be observed by comparing Plates 305 and 306. On the average, both are larger than potato starch granules, which are the largest of those in our common commercial starches. (Canna starch, however, has granules considerably larger than those of *Alstroemeria*). The average granule size of *Alstroemeria* is shown in table 1 in comparison with that of tapioca, potato, and corn starches.

When starch granules are heated in water, they lose their birefringence (i.e., they no longer exhibit a cross between crossed Nicol prisms) and they swell to several times their original size. The loss of birefringence results from changes taking place within the granule,—a phenomenon known as "gelatinization." A starch is broadly characterized by the temperature at which gelatinization occurs. Not all the granules in any starch sample gelatinize at the same temperature, however; hence each starch has a gelatinization temperature range. At the lower limit of the range a few granules are just beginning to lose their birefringence, while at the upper limit all of the granules have entirely lost birefrin-



(Upper) Granules of *Alstroemeria aurantiaca* starch. Note the double granule at the top. (Lower) Same field as (Upper) between crossed Nicol prisms. Note the single cross in most granules as compared with "laced effect" in the compound granules shown in Plate 306, (Lower). Magnification 500x.

gence. Usually large granules gelatinize at a lower temperature than small ones, but factors other than granule size also affect the gelatinization temperature.

The two species of *Alstroemeria* starch studied started to gelatinize at a lower temperature than tapioca or potato starch, but otherwise had a similar gelatinization temperature range. Data are given in table 1.

Following gelatinization, starch granules usually swell greatly. Simple granules then look like inflated sacs, the size and shape depending upon the kind of starch. Swollen granules of *A. aurantiaca* are shown in Plate 307 (upper). During swelling, compound granules often break apart into the individual constituent granules. Or the constituent granules may continue to hold to each other even when greatly swollen. For the most part, the constituent granules of *A. chilensis* tend to cling together, so that peculiar and unusual forms result, as shown in Plate 307 (lower).

Root starches, in general, contain less nitrogen and more ash than cereal starches. The *Alstroemeria* starches studied, like high-grade tapioca starch, contained even less nitrogen than ordinary potato starch, but they had more ash than the average tapioca or potato starch. Analytical results are recorded in table 1.

CHEMICAL NATURE OF ALSTROEMERIA STARCH

Two kinds of starch molecules are known to exist. In one, called "amylose," the glucose residues of which starch is composed are arranged in a linear manner; in the other, known as "amylopectin," the arrangement of the glucose residues is non-linear, i.e., perhaps branched or folded. Most starches consist of about 20 to 30 percent amylose and 60 to 70 percent amylopectin. Seeds of a few plants (the so-called "glutinous" or "waxy" cereals) have starch comprised largely, if not wholly, of amylopectin. Starch from wrinkled-seeded, garden-type peas is composed of about 60 percent amylose and the remainder amylopectin (2).

Because the characteristics of the paste made by heating starch granules in water depend largely upon the ratio of amylose to amylopectin in the starch, a knowledge of this ratio is important. Such information is most conveniently obtained by determining the iodine-sorptive capacity of the starch. By taking one-half the number of milligrams of iodine sorbed by one gram of the starch, a value is obtained which approximates the percent of amylose present (2). This calculation involves the assumption that amylose from all sources sorbs about the same amount of iodine.

The iodine-sorptive capacities of the two *Alstroemeria* starches studied were within the range of those of commercial starches (see table 1), indicating an amylose content of about 20 to 25 percent.

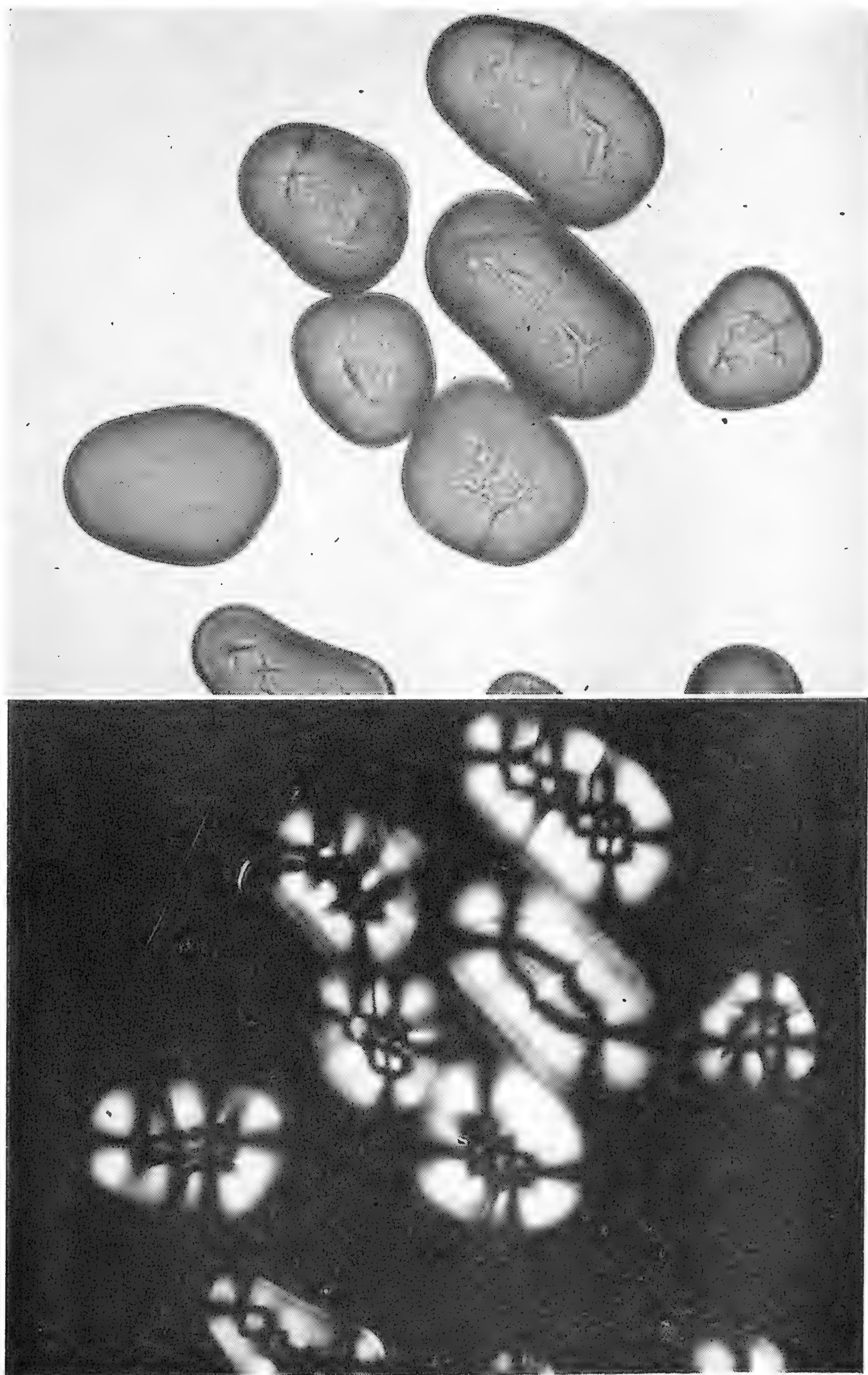
PASTE CHARACTERISTICS

In paste characteristics, *Alstroemeria* starches resemble potato or tapioca starch more than corn starch. (See table 1). *Alstroemeria* starch pastes are long and tacky, i.e., viscid and sticky, in contrast to the short,

Table 1.—A comparison of *Alstroemeria* starch characteristics with those of starch from other sources.

	<i>Alstroemeria chilensis</i>	<i>Alstroemeria aurantiaca</i>	Tapioca	Potato	Corn
Granule size	Maximum	133 x 167 μ	35 x 35 μ	60 x 100 μ	30 x 30 μ
	Average	87 x 112 μ	15 x 15 μ	50 x 75 μ	15 x 15 μ
	Minimum	53 x 57 μ	5 x 5 μ	10 x 10 μ	5 x 5 μ
Gelatinization temperature	31° - 71° C.	34° - 65° C.	61° - 66° C.	49° - 64° C.	47° -78° C.
Analyses *	Nitrogen	0.01%	0.01%	0.02%	0.04%
	Ash	0.64%	0.09%	0.40%	0.06%
Iodine sorptive capacity	I ₂ /gm. starch	50 mg.	37 mg.	43 mg.	53 mg.
Paste characteristics	(a) Length and tackiness	Very long and tacky	Very long and tacky	Less tacky than <i>Alstroemeria</i>	Short; not tacky
	(b) Turbidity	Opalescent and translucent	Opalescent and translucent	Opalescent and translucent	Semi-opaque
	(c) Viscosity	High	High	High	Low
	(d) Retrogradation	Slow	Slow	More rapid than <i>Alstroemeria</i>	Rapid

* Moisture-free basis



(Upper) Compound granules of *Alstroemeria chilensis* starch. (Lower) Same field between crossed Nicol prisms. Magnification 500x.
Plate 306



(Upper) Gelatinized starch granules of **Alstroemeria aurantiaca**. (Lower) Gelatinized starch granules of **Alstroemeria chilensis**. Magnification 235x

non-tacky pastes of most cereal starches. (Corn starch pudding mix gives a short paste, for example). When first prepared, pastes of *Alstroemeria* starch are opalescent and translucent, but slowly become more opaque (i.e., "retrograde"). Their viscosity is high, in the general range of that of potato and tapioca starch pastes.

POSSIBLE USES FOR ALSTROEMERIA STARCH

The relative commercial importance of a starch in any given region is determined primarily by the abundance and hence the cost of the commodity from which it is obtained. In the United States, corn starch is the least expensive and therefore, the most widely used starch. In Europe, on the other hand, where special varieties of potatoes are grown for their high starch content, potato starch occupies first place.

If there is only a minor difference between two starches in their suitability for a given purpose, the cheaper rather than the better one may be used because of economic advantage (3). There are some cases, however, in which a relatively expensive starch is employed because its paste characteristics uniquely adapt it for specific applications. Starches giving long, tacky, highly viscous pastes which retrograde slowly are especially desired in some cases for sizing of paper and textiles, for the preparation of adhesives used in the production of envelopes, paper bags, and postage stamps, and for food use as, for example, in prepared pudding and pie mixes. For some of these purposes, tapioca starch is employed in this country, even when its cost is considerably above that of corn starch.

Alstroemeria starch is so similar to tapioca starch in its paste characteristics that, if both were on the market, cost would probably be the determining factor. Even under conditions such that the starches could be sold at equal cost, it is doubtful whether a starch newly introduced to the market could compete with one of the same characteristics already commercially established. It is hardly probable, therefore, that *Alstroemeria* will become of industrial importance in this country as a source of starch.

SUMMARY

Starches have been prepared from the tuberous roots of *Alstroemeria aurantiaca* and *A. chilensis*, and their properties studied. The granules of the former are simple, while those of the latter have an unusual compound nature. Both give pastes similar in characteristics to pastes of other so-called root starches, such as potato and tapioca starch.

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1. Reichert, Edward T. The differentiation and specificity of starches in relation to species, genera, etc. Publ. Carnegie Inst., Washington, No. 173, 2 vols. 1913.
2. Hilbert, G. E. and MacMasters, M. M. Pea starch—a starch of high amylose content. J. Biol. Chem., 162, (2), 229-238 (1946).

3. U. S. Tariff Commission. Starches, dextrines and related products. Report No. 138. Second series, p. 135, et seq.

THE GENUS PYROLIRION

J. C. TH. UPHOF

William Herbert¹ proposed the genus *Pyrolirion* in 1821, in his "Appendix." The name was derived from two Greek words meaning "fire" and "lily," respectively, and the generic group was taken over by the same author² in his well known monograph of the Amaryllis Family in 1837. Herbert knew perfectly well the characteristics of the genera that he described in 1821, but later Baker³ included *Pyrolirion* under *Zephyranthes*, to which, undoubtedly, it is related. Following Baker, the Index Kewensis, p. 667, refers the species of *Pyrolirion* to *Zephyranthes*. It is therefore understandable that Pax and Hoffman⁴ followed these authorities, and reduced *Pyrolirion* to a subgenus of *Zephyranthes*.

Earlier, however, Otto Stapf had prepared his extensive description of *Habranthus robustus* to accompany Plate 9126 in Curtis' Botanical Magazine in 1926. During his studies he came to the conclusion that *Pyrolirion* and certain other genera that had been distinctly outlined by Herbert, should be maintained. An important difference to Herbert was the habit of the perianth which he describes in *Pyrolirion* as erect; in *Zephyranthes* as sub-erect, and in *Habranthus* as declinate. In *Amaryllis* (syn. *Hippeastrum*) the perianth is declinate but the tube is abbreviated whereas in *Habranthus* the perianth is declinate but the tube is not abbreviated. Sealy⁵ gives us a clear comparison between *Pyrolirion* and *Zephyranthes* with reference to the characteristics of the spathe, perianth, stamens and stigma. The reader is referred to this masterful exposition of the generic limits of the genera *Pyrolirion*, *Zephyranthes*, *Habranthus* and *Amaryllis* (syn. *Hippeastrum*.)

Genus PYROLIRION Herbert

Bulbous plants, bulbs usually more or less ovate; older bulbs surrounded by offsets; leaves narrow, somewhat erect, attenuate at both ends. Spathe bifid, tubular, formed into a sheath below. Scape one-flowered. Bractioles absent. Flowers erect. Perigone conspicuous, relatively large. Tube narrow cylindrical in the lower part, spreading recurved. Filaments erect. Anthers incumbent. Style almost erect to erect; stigma trifid; its segments spatulate.

When Herbert proposed the genus *Pyrolirion* he admitted three species,—*P. flammeum*, *P. aureum* and *P. flavum*. Since that time the number of species has been increased but slightly. The generally accepted additions are *P. boliviense* and *P. xiphopetalum* by Baker.

1 William Herbert. An Appendix (to Edward's Botanical Register; Treatise on Amaryllae). London, 1821. p. 37.

2 William Herbert. Amaryllidaceae. London, 1837. pp. 183-184.

3 J. G. Baker. Handbook of Amaryllaeae. London, 1888.

4 F. Pax und K. Hoffman. Amaryllidaceae in Engler und Prantl; Die Natuerlichen Pflanzenfamilien. 2 aut. 15a: 406-407. 1930.

5 J. R. Sealy. *Zephyranthes*, *Pyrolirion*, *Habranthus* and *Hippeastrum*. Journ. Roy. Hort. Soc. 62: 195-209. 1937.

With the genus *Pyrolirion* may be mentioned *Zephyranthes Beustii* Schinz, *Z. Briquetii* Macbride, *Z. parvula* Killipp all native to Peru and *Z. pseudocolchicum* Kranzl from Bolivia, however, a more detailed study will be necessary to be able to decide whether these four species form part of *Pyrolirion*. No material could be studied for comparison during the war period.

DESCRIPTION OF THE SPECIES

1. *Pyrolirion aurantiacum* Lemaire in Le Jardin Fleuriste. Plate 377, 1854.

Description.—Bulb small, surrounded by a blackish tunic. Leaves from 2 to 6, sometimes 8, occurring about the same time as the scape, linear, convex below, somewhat canaliculate, attenuate-obtuse, longer than



Fig. 179a. **Pyrolirion aureum.**
Photo by Edith B. Strout.

the scape, of a beautiful green, somewhat glaucous. The scape is fistulous, cylindric, glaucous, somewhat striate. Spathe membranous. Flowers orange. Perianth infundibuliform-campanulate, large, sessile, 7 to 8 cm. long; tube 1.5 to 2 cm. long and 8 to 10 mm. wide. Segments about 3 cm. long and toward the middle, 12 to 14 mm. wide. Apex becoming gradually pointed. Filaments reaching to the throat of the perianth, inserted at the extreme base. Anthers oblong. Style about as long or longer than the stamens, cylindric, straight. Stigma distinctly deeply 3-cleft. Ovary cylindric, slightly 3-angled. Ovules numerous.

Notes.—This attractive species differs from *P. aureum* by its sessile flowers, its straight style, its stamens and the striated scape. It is distinguished from *P. flammeum* by its more numerous leaves, its longer scape and much larger flowers.

2. *Pyrolirion aureum* Herbert in Appendix Bot. Reg. 37, 1821.—Amaryllidaceae, 183, 1837.—*Zephyranthes aurea* (Herb.) Baker Handb. Amaryllidaceae 37, 1888.—*Amaryllis aurea* Ruiz et Pavon Flora Peruv. T. 286 A. 17.

Description.—Bulb roundish, 2.5 to 3 cm. in thickness. Leaves 4 to 5, linear, 3 dm. in length and 6 mm. wide. Produced with the flowers in December and January. Scape 1.5 to 3 dm. long. Spathe membranous, 3 cm. long, the lower half cylindric. Limb of the perianth erect, brightly yellow; tube funnel-shaped, being longer than the segments, dilated in the middle; the throat furnished with minutely toothed scales; segments acute, equal in length, 3 cm. long, 10 to 12 mm. wide. Stamens adnate toward the middle to the tube of the perianth. Filaments erect, reaching almost the apex of the segments. Ovary sessile.

Notes.—This species has been found in Valle de Lima, Peru, where plants were seen in the corn-fields and in other localities. Matthews Nr. 400.

3. *Pyrolirion boliviense* (Baker) Sealy, Journ. Roy. Hort. Soc. 62: 207, 1937.—*Zephyranthes boliviensis* Baker Handb. Amaryllidaceae 38, 1888.

Description.—Bulbs roundish, 2½ to 3 cm. in thickness; tunic 3 to 7.5 cm. in length. Leaves have not been described. Scape 1.5 to 3 dm. long, slender. Spathe 2 to 2.5 cm. long. Limb of the perianth erect, 5 cm. long, whitish; tube as long as the segments, cylindric below, the upper half funnel-shaped. Segments of the same length, oblong-lanceolate, 6 to 8 mm. in width. Stamens adnate to the middle of the tube; anthers opposing the base of the segments. Ovary sessile; style trifid to the base, overlapping the stamens.

Notes.—Native to Bolivia near Sorata at an altitude of 2500 to 3000 meters. Mandon 1194 in part. Flowers appear in September.

4. *Pyrolirion flammeum* Herbert in Appendix Bot. Reg. 37, 1821.—Amaryllidaceae 184, 1837.—*Zephyranthes flammea* Baker. Handb. Amaryllidaceae. 38, 1888.—*Amaryllis flammea* Ruiz et Pavon. Flora Peruv. T. 286 B. 17.

Description.—According to Baker this species: "Just like *Z. aurea*, but the color of the flower flame-red. Segments furnished with small truncate crenate membranous scales at base . . ."

Notes.—Reported from Valle de Lima, Peru, Pavon.

5. *Pyrolirion xiphopetala* (Baker) Sealy, in Journ. Roy. Hort. Soc. 62: 208, 1937. *Zephyranthes xiphopetala* Baker, in Henry H. Rusby, On the Collections of Mr. Miguel Bang in Bolivia. Part II. Mem. Torrey Bot. Club. 4: 268, 1896.

Description.—Bulb round, 3 to 4 cm. in diameter. Outer scales membranous, brown. Leaves have not been observed, they develop more than likely not during the flowering period. Scape 15 to 30 cm. long, terminated by an erect, sessile flower, surrounded at the base by a white membranous spathe, 1-valved, 2½ cm. or less in length. Perianth erect, infundibuliform, clear yellow, 4 to 5 cm. long. Tube of the perianth 8 mm. long, cylindrical below the dilated apex. Segments lanceolate, 4 mm. wide near the middle, becoming narrow toward the apex. Length

of the stamens is half of that of the lobes of the perianth. Anthers spirally curled up. Style deeply trifid, overtopping the anthers.

Notes.—The original description is based on a specimen found in the vicinity of Cochabamba, Bolivia, Bang nr. 890, 1891. It was collected by Mr. Miguel Bang together with numerous other species from Bolivia. He was educated in gardening at Kew and went in 1883 to Bolivia for the purpose of collecting Orchids and later on also collected herbarium specimens from that region for different institutions. His collection of Amaryllids was identified by J. G. Baker.

THE TRIBE GALANTHEAE

HAMILTON P. TRAUB AND HAROLD N. MOLDENKE

[Criteria: Karyology, $x = 7, 8, 9, 10, 11, 12$. Ovary inferior; scape leafless; divisions of the perigone free (tepals) in *Lapiedra*, *Galanthus* and *Leucojum*, excepting in subgenus *Acis*, in which the divisions are barely united at the base (= tepaltube and tepalsegs); tepals in *Lapiedra*, and tepals, or tepalsegs in subgenus *Acis*, tepals in *Leucojum* subequal; tepals in *Galanthus* dimorphic; plants are either (a) schistandrous (in *Lapiedra*), or (b) porandrous (in *Leucojum* and *Galanthus*); style filiform or strumose.]

With keen insight William Herbert (1837) discerned that the species included in this group—*Galanthaeae*, commonly called Snowbells on the European Continent and Snowdrops in Britain—show an evolutionary tendency to become porandrous. This means that the anthers open only partially and the pollen is discharged through two small holes at the summit, or there may be a lateral slit of the anther (running nearly to the base), which is superadded to the terminal pore. The porandrous condition may be advantageous to pollination in drooping flowers, and mutations in the direction of porandrosity would therefore tend to be preserved when pedicels are cernuous. Since such evolution is from schistandrous ancestors with anthers that split for their entire length, we may expect to find more primitive species that still retain this character and that arose also from the common ancestral stock, unless these have become extinct, or the collaterally evolved line or lines have taken another direction and have passed the tribal boundaries as delimited for the *Galanthaeae*. In this connection it should be noted that Herbert (1837) discerned an affinity between *Lapiedra* Lag. and the rest of the *Galanthaeae*. Although he placed *Lapiedra* next to *Gethyllis* Linn. and *Sternbergia* W. & K., he asserted that *Lapiedra* may “prove to be porandrous in which case it would stand amongst *Galanthaeae*, probably next to *Leucojum*”. Although apparently it was later found that *Lapiedra* is schistandrous, it has been included in this natural group since 1887, when Pax admitted it to his *Galanthinae*. Before 1887, this genus was variously placed, but Pax apparently considered the characters of the leafless scape, and the lack of a tepaltube in most cases, of sufficient importance to place it here. The systematic position of *Lapiedra* now appears to be secure among the *Galanthaeae*, but it must be realized that all of the needed evidence has not been assembled. It is particularly important to determine the chromosome complement before considering the case closed.

This natural plant group was recognized by Herbert (1836) as section *Galanthaeae*, reported by Lindley but accredited to Herbert, and later (Herbert, 1837) as suborder *Galanthaeae*, Order *Amaryllidaceae*. In 1836 he included the genera *Galanthus* Linn., *Acis* Salisb., and *Leucojum* Linn., and in 1837 the genus *Erinosma* Herb. was added. Kunth (1850) as well as Baker (1878) recognized this group, but unfortunately the latter fell under the spell of the Bentham & Hooker f. (1883) classifica-

tion of the *Amaryllidaceae*, and in his final work (Amaryll. 1888) adopted it. As has been previously indicated, Bentham & Hooker f. (1883) ignored the classification of Herbert in most particulars. In this case, *Acis* Salisb., *Erinosma* Herb., and the two genera—*Nivaria* Medic., proposed in 1790, and *Ruminia* Parl., proposed in 1858—were reduced to the synonymy of *Leucojum* Linn. This reduction on the whole was apparently justified, but it was unfortunate that the genus *Leucojum* together with *Lapiedra* and *Galanthus* were grouped under the “blanket” subtribe *Genuinae*, of his tribe *Amarylleae*.

However, this lead was not generally acceptable, for Pax (1887) and Pax & Hoffman (1930) recognized the group as subtribe *Galanthinae*, but without citing the work of Herbert (1836, 1837), and included *Galanthus*, *Lapiedra* and *Leucojum*. Hutchinson (1934) again elevated the group to tribal rank—Tribe *Galantheae*—without giving any literature citations or a diagnosis; and on this basis the tribe was recognized by Traub (1938). Up to now this tribal designation has not been properly accredited.

The Tribe *Galantheae* as recognized in the present work is founded on *Galanthus* Linn. as the type, and with *Lapiedra* Lag. and *Leucojum* Linn. as additional genera. On the basis of the criteria indicated at the beginning of this article, the Tribe *Galantheae* can be readily separated from the other tribes of the *Amaryllidaceae*.

The karyology of the species included in the *Galantheae* has not as yet been adequately studied except in *Leucojum*. The chromosome complement in *Lapiedra* is still unknown, and in *Galanthus* the basic numbers have been established for only three out of a total of nineteen species. On the basis of the available evidence, the pattern for the basic numbers, $x = 7, 11, 12$, supports the grouping of this tribe under the Subfamily *Euamaryllidoideae* Traub.

Tribe GALANTHEAE (Herbert ex Baker) Hutchinson, Baker, Jour. Bot. 18: 161-162. 1878; Hutchinson, Fam. Fl. Pl. 2: 132. 1934; Traub, Herbertia 5:112. 1938.

SYN.—Sect. *Galantheae* Herbert, in Lindley Nat. Syst. Bot. ed. 2. 329. 1836; suborder *Galantheae* Herbert, Amaryll. 63: 188-189, 329-333, 410. 1837; order *Galantheae* Salisb. Gen. Pl. Fragm. 96. 1866; subtribe *Galanthinae* (without citations) Pax, Engl. & Prantl, Nat. Pflanzenfam. ed. 1. 2(5): 105. 1887; Pax & Hoffman, Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 403-404. 1930.

TYPE GENUS.—*Galanthus* Linn.

DIAGNOSIS.—Karyology: *Lapiedra*, no reports; *Leucojum*, $x = 7, 8, 9, 11$; *Galanthus*, $x = 7, 10, 12$. Bulbous herbs; leaves lorate, narrow-linear, or filiform; scape leafless; spathe-valves 1 or 2; umbel 1- to 8-flowered; ovary inferior; perigone white, or white tipped with green or yellow, or tinged red, or rarely rose-red; divisions of the perigone free (= tepals), or slightly united at the base (= tepaltube and tepalsegs); tepals or tepalsegs subequal or dimorphic; plants usually porandrous,

rarely schistandrous; fruit a loculicidally dehiscent 3-valved capsule; seeds turgid, subglobose or ellipsoid; seed coats pale or black. Three recognized genera, *Lapiedra* Lag., *Leucojum* Linn. and *Galanthus* Linn. (type).

The probable relationship of the three genera from an evolutionary standpoint is indicated in the following key:

Key to the genera of the Tribe GALANTEAE

- 1a. Plants schistandrous; tepals fairly equal, style filiform
(southern Spain)1. *Lapiedra*
- 1b. Plants porandrous:
 - 2a. Divisions of the perigone subequal, free (= tepals),
or sometimes slightly united at base (= tepaltube)
and tepalsegs; style filiform or strumose (Europe
and western Asia)2. *Leucojum*
 - 2b. Divisions of the perigone distinctly dimorphic, free
(= tepals); style filiform (Europe and western
Asia)3. *Galanthus*

THE GENUS **LAPIEDRA**

As indicated in the key for the genera of Tribe *Galantheae*, *Lapiedra* is the most primitive member of the group in the scale of evolution for the perigone is fairly regular, the anthers are attached to the filaments at the middle, the plant is apparently schistandrous—the anther locules splitting for their entire length—and the style is filiform.

The genus *Lapiedra*, based on *Lapiedra Martinezii* Lag., was proposed by Lagasca (1816). According to Herbert (1837, p. 410), the generic name *Lapiedra* was derived from the Latin and Spanish words for stone, *Lapis* and *piedra*. However, it appears to be more probable, to the present writers, that the name was coined from the Spanish words *la* (= the) and *piedra* (= stone), implying that it is found growing in rocky soil.

Herbert (1837) changed the name of the one species to *Lapiedra Placiana* Herb., on the basis of the pre-Linnean name *Sparganium Placae* (Clus. Rar. Pl. Hist. 164. 1601.). In a hasty postscript at the very end of the text (Herbert, Amaryll. “p. 416”. 1837) Herbert states, after the receipt of a plant of *Pancratium pariflorum* Redoute (= *Vagaria parviflora*) which he considered as identical with *L. Placiana* Herb., that “The name *Lapiedra Placiana* must therefore be removed from the *Oporanthiform* section, and substituted for *Vagaria parviflora*, which must be expunged”. However, Herbert was in error in considering *L. Placiana* Herb. (= *L. Martinezii* Lag.) as identical with *Vagaria parviflora*. The species, *Lapiedra Martinezii* Lag. is distinct and remains as the basis of the genus *Lapiedra*. This interpretation is in harmony with Bentham & Hooker f. (1883), Pax (1887), Baker (1888) and Pax & Hoffman (1930), who recognize the genera *Vagaria* and *Lapiedra*, but do not mention Herbert’s conclusions in 1837.

In 1896, a second species, *Lapiedra chilensis* F. Philippi, native to Chili, was proposed. Probably this will prove to be a type with an inferior ovary belonging with the *Allieae*, which abound in Chili. Evolution in this direction in the *Allieae* is a possibility, but it is also possible that it might belong with the inferior-ovaryed amaryllids that also are numerous in that country. In the first case it would be a recent development, but in the latter instance, it might represent a primitive relict species. In either case, it would be logical to consider it as the basis of a new genus. *Lapiedra chilensis* F. Phil. is widely separated geographically from *L. Martinezii* Lag., the type of the genus, native to southern Spain. Although this in itself does not rule out the possibility of primary relationship, it should recommend a very critical approach in checking the hypothesis of close affinity. However, pending further investigation, it is maintained here tentatively because there is no other logical course suggested at present. Botanists working in the vicinity of Chuchini, Chili, are requested to make new collections of this plant and send specimens, living bulbs if possible, to the writers so that the karyological and gross morphological characters may be studied more in detail. Only on this basis will it be possible to assign the plant to its final place in a natural classification. In case *Lapiedra chilensis* F. Phil. should later be finally assigned to *Lapiedra*, the following distinctions between it and the type species would serve to rank them from an evolutionary point of view:

- 1a. Ovules many per locule, umbel 2- to 4-flowered (Chili) *chilensis*
- 1b. Ovules (= seeds) 1 to 2 per locule, umbel 4- to 8-flowered (southern Spain) *Martinezii*

A translation of the type description of *Lapiedra chilensis* F. Phil., is reproduced here for the convenience of those interested in the subject:

LAPIEDRA CHILENSIS F. Philippi, in Anal. Univ. Chile, xciii: 144-145, Lam. VI. 1896.

“Scape very slender, up to 10 cm. tall, scarcely 1 mm thick in the dried specimen; flowers 2.4, umbellate; spathe-valves 2, lanceolate, longer than the pedicels; pedicels subtended at the base by setaceous bracts as long as or longer than the pedicels; tepals of the perigone equal, spreading, linear, acute, white with three purple nerves at the center; filaments calillary, half as long as the tepals, purple; anthers saggitate at the base, scarcely half as long as the filaments, yellow.

“Discovered by the famous Guillermo Geisse on the estate “Chuchini” near Illapel in February.”

The illustration (Lam. VI) that accompanies the type description shows numerous ovules per locule. F. Philippi's statement that the anatomy of *Lapiedra chilensis* F. Phil., corresponds to that reported in Engler and Prantl (ed. 1) for *Galantheae* cannot be considered as conclusive evidence of close affinity.

In Index Kewensis, the authorship is given as “F. Phil., ex R. A.

Phil.", but the text shows plainly that F. Philippi alone proposed the species.

For the present, the genus *Lapiedra* Lag. will be treated as monotypic.

Genus 1. LAPIEDRA Lagasca

Nov. Sp. et Gen. 14. 1816; Herbert, Amaryll. 188-189. 1937, Kunth, Enum. Pl. 5: 694. 1850; Baker, Amaryll. 21. 1888.

DIAGNOSIS.—Karyology, no reports. Spathe-valves 2; ovary superior, 3-celled; perigone regular, tepals 6, subequal, spreading, persistent; stamens 6, epigynous, filaments filiform, anthers lanceolate, deeply saggitate at the base, erect (or horizontal ?); style filiform, stigma simple; capsule small, deeply 3-lobed, loculicidally 3-valved; seeds 1 or 2 in a cell, turgid, with shining black crustaceous coats. Apparently monotypic.

1. LAPIEDRA MARTINEZII Lagasca, in Nov. Sp. et Gen. 14. 1816; Kunth, Enum. Pl. 5: 694. 1850; Boiss., Voy. Bot. pl. 171. 1839-45; Baker, amaryll. 21. 1888.

SYN.—*Lapiedra Placiana* Herb., Amaryll. 188-189. 1837; *Crinum Martenizii* Sprengel, Syst. 2: 56. 1825-28.

DESCRIPTION.—Bulb ovoid, 5 cm. in diameter, neck long (absent according to Boissier, Voy. Bot. pl. 171); leaves 2 or 3, lorate, developed after the flowers, kneeled with white; scape slender, ancipitous, 15 cm. tall; umbel 4- to 8-flowered; spathe-valves 2, membranous, linear; pedicels not cernuus, longer than the flowers; perigone regular, tepals 6, lanceolate, subequal, persistent, 9 mm. long, white, with a broad green keel; stamens epigynous, filaments filiform, anthers lanceolate, deeply saggitate at the base, erect (horizontal according to Boissier, Voy. Bot. pl. 171); ovary 3-celled, ovules several in a cell, superposed; style filiform, stigma simple; capsule small, 7 mm. in diam., deeply 3-lobed, loculicidally 3-valved; seeds 1 or 2 in a cell, turgid, with shining black crustaceous coats.

RANGE.—Southern Spain.

NOTES.—A study of the chromosome complement of *Lapiedra Martinezii* is urgently needed. It is hoped that Dr. A. Fernandes at the University of Coimbra, Portugal, or one of his students, will find time to do this public service.

The description of Baker (1888) is slightly at variance with that of Boissier (1839-45) as indicated in the above description.

THE GENUS LEUCOJUM

The species of *Leucojum* are porandrous and the perigone may consist of tepals or of a tepaltube that is barely evident and tepalsegs, but in either case the tepals or tepalsegs are subequal. The style may be either filiform or strumose.

Linnaeus, in Species Plantarum (1753), recognized two species of

Leucojum Linn.—*L. vernum* Linn., the type, and *L. autumnale* Linn. Salisbury (1807) proposed a new genus, *Acis* Salisb., on the basis of *L. autumnale* Linn. Herbert (1837) admitted three species under *Leucojum*,—*L. aestivum*, Linn. *L. pulchellum* Salisb., and *L. Hernandezianum* Camb. He also recognized the genus *Acis* Salisb., and proposed another genus, *Erinosma* Herb., with *L. vernum* Linn, as the type.

Kunth (1850) recognized the three genera, *Leucojum*, *Erinosma* and *Acis*, but Baker (1878) reduced *Erinosma* and *Acis*, together with *Ruminia* Parl. to the synonymy of *Leucojum*. However, he recognized as subgenera under *Leucojum* two groups formerly considered as genera, *Erinosma* Herb., and *Acis* Salisb., the latter including also *Ruminia* Parl. as a synonym. Bentham & Hooker f. (1883) followed Baker (1878) but added a third subgenus, *Euleucojum* B. & H. f. on the basis of *L. aestivum*. Finally, Baker (1888) proposed a fourth subgenus, *Ruminia* (Parl.) Baker, on the basis of *L. roseum*, and admitted a total of 9 species under the four subgenera.

In the present work, the four subgenera as recognized by Baker (1888) are maintained, and a total of 11 species are admitted.

Genus 2. LEUCOJUM Linnaeus

Sp. Pl. ed. 1289. 1753; Gen. Pl. ed. 5.140. 1754; Jussieu, Gen. Pl. 55. 1789; Jaume St.-Hilaire, Exp. Fam. Nat. 1: 139. 1805; Link, errore *Leucojum*, Enum. Pl. 1: 510. 1821; Herbert, Amaryll. 332-333. 1837; Kunth, Enum. Pl. 5: 471-477. 1850; Baker, Jour. Bot. 16: 161-162. 1878; Gard. Chron. 399. 1879; Bentham & Hooker f., Gen. Pl. 3(2): 720. 1883, errore *Leucoium*; Pax, Engl. & Prantl, Nat. Pflanzenfam. ed. 1. 2(5): 105. 1887; Baker, Amaryll. 18-21. 1888; Pax & Hoffman, Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 404. 1930.

SYN.—*Nivaria* Medic., in Act. Acad. Theod. Palat. vi. Phys. 421. 1790; Moench, Meth. 279. 1794; *Acis* Salisb., Parad. Lond. sub t. 74. 1807; *Erinosma* Herb., Amaryll. 330. 1837; *Ruminia* Parl., Due Nouv. Gen. Monocot. 3: ex ej. Fl. Ital. iii. 84. 1858.

TYPE SPECIES: *Leucojum vernum* Linn.

DIAGNOSIS.—Karyology, $x = 7, 8, 9, 11$. Rootstock a tunicated bulb; leaves filiform, or lorate with slender or broader blades; spathe usually single; umbel 1- to several-flowered, flowers white, tinged with red, or green, rarely rose red; perigone usually of tepals, tepaltube with tepalsegs rarely (subg. *Acis*) present; tepals or tepalsegs subequal, ovate or oblong, spreading; stamens epigynous, porandrous; filaments filiform, shorter than the linear-oblong basifixed anthers; ovary inferior, 3-celled; ovules many in a cell, superposed; style filiform or strumose near the apex; stigma minute, capitate; fruit a capsule, finally dehiscing loculicidally into 3 valves from the top; seeds subglobose, usually black. Eleven recognized species, ranging from the rim of the Mediterranean, and from western Europe, Portugal, Spain, and France to the Crimea and Armenia.

KARYOLOGY

The karyology of the genus *Leucojum* fortunately has been admirably worked out by Neves (1939) who has published formulas for seven of the eleven recognized species as shown in Table 1. With this basic information at hand it is now possible to make a synthesis considering also the morphological data.

TABLE 1

Karyology of the Genus *Leucojum* ¹

Chromosome number, 2x, and formula ²	Species	Subgenus
2x=22=2:LL+4:Lp+4:L.+4:l. +4:m.+4:m.'	1. <i>L. aestivum</i> Linn.	I. EULEUCOJUM (x=11)
2x=22=2:LL+4:Lp+4:L.+2:l. +2:l'.+6:m.+2:m.'	2. <i>L. pulchellum</i> Salisb.	
2x=22=2:LL+14:Lp+4:L.+2:L.'	3. <i>L. vernum</i> Linn.	II. ERINOSMA (x=11)
2x=18=4:LL+2:Lm+2:Lp+2:L. +6:m.+2:m.'	4. <i>L. hyemale</i> DC.	III. RUMINIA (x=9)
2x=?=?	5. <i>L. tingitanum</i> Baker	IV. ACIS (x=7, 8)
2x=?=?	6. <i>L. Fontianum</i> Marie	
2x=16=2:LL+2:mm+2:Lm+ 2:lm+2:Lp+2:L.+ 2:pp+2:p.	7. <i>L. roseum</i> Martin	
2x=?=?	8. <i>L. longifolium</i> J. Gay ex Salisb.	
2x=14=2:LL+4:ll+2:Lm+2:Lp +2:Lp'+2:L.	9. <i>L. trichophyllum</i> Schousb.	
2x=?=?	10. <i>L. valentinum</i> Pau	
2x=14=6:LL+2:ll+2:Lm+2:Lp +2:L.'	11. <i>L. autumnale</i> Linn.	

¹ The karyological data in the table are from Neves Bol. Soc. Brot. 13: 545-572. 1939).

² The system used by Neves to describe the ideograms (chromosome complements) of *Leucojum* species was devised by Fernandes. This system indicates the relative length of the chromosome and approximate position of the centromere. The letters L, M, and P are taken from the Latin words, *longus* (long), *medius* (medium) and *parvus* (short), to which are added the intermediate types l and i; m; and p. An apostrophe indicates the satellite chromosome.

This happens to be an instance where the karyological data quite readily corroborate the key to the species, given later in the article, that was prepared on the basis of the gross morphology.

The highest basic number, x=11, is correlated with lorate leaves, absence of a tepaltube, strumose style, and unlobed epigynous disc. Within this group, a greater number of chromosomal types in the basic complement is associated with 4- to 8-flowered umbel, black crustaceous

seed coats, and absence of a conspicuous strophiole (subg. *Euleucojum*); and a reduced number of chromosomal types in the basic complement, is correlated with the 1-flowered umbel, pale membranous seed coat, and a conspicuous strophiole (subg. *Erinosma*).

The lower basic number, $x=9$, is associated with narrow-linear leaves, absence of the tepaltube, filiform style, and 6-lobed epigynous disc (subg. *Ruminia*).

The lowest basic numbers, $x=7, 8$, are correlated with narrow-linear or filiform leaves, very short tepaltube, unlobed epigynous disc, and filiform style (subg. *Acis*).

Neves (1939) concludes that the basic number, $x=11$, is apparently derived from $x=7$, although he observes that Sato (1937) admits the possibility that in *Leucojum autumnale*, the smaller number, $2x=14$, may have evolved by fusion or translocation of part of the chromosomes of the ancestral type ($2x=24$).

From an evolutionary standpoint, the present writers believe that the latter viewpoint is the sounder one. The primitive types are most likely those with lorate or narrow-linear leaves and without a tepaltube. The more advanced species are those with narrow-linear or filiform leaves and with a tepaltube. From this standpoint it appears that Salisbury (1807) was justified in proposing the genus *Acis* Salisb., to accomodate the species centering around *Leucojum autumnale*. In this connection it is also of interest to note that attempts by the senior author to cross *L. autumnale* with *L. aestivum* did not give viable seeds for the ovules began to develop but later aborted. For the present, however, *Acis* is retained as a subgenus under *Leucojum*.

DOUBTFUL AND REJECTED SPECIES

There has been little confusion concerning the delimitation of the genus *Leucojum* and consequently the species that have to be rejected are few.

1. *Leucojum strumosum* Ait. Hort. Kew, ed. 1. 1: 407. 1789. = *Hessea filifolia*.

2. *Leucojum* (errore *Leucoium*) *capitulatum* Lour. Fl. Cochinch. 199. 1790; J. A. & J. H. Schultes, in Roem. & Schult., Linnaeus, Syst. Veg. 7(2): 786-787. 1830.

According to Herbert (1837), this "is unquestionably a *Curculigo* or *Molineria*. They [J. A. & J. H. Schultes] have been misled by the alleged thickness of the points of the limb, without considering the plicate leaves and the hairy exterior of the perianth."

3. *Leucojum biflorum* Larranaga, Escritos D. A. Larranaga (Publ. Inst. Hist. Geog. Urug.) 2: 131. 1923, non Simonkai (1879).

The epithet proposed by Larranaga is a later homonym, and the proposed species is therefore without a name. Furthermore, the identity of the proposed species is highly uncertain. In the absence of a type specimen or illustration, the incomplete description given by Larranaga—"Spathe 2-valved; umbel 2-flowered; style filiform; stamens short"—is not sufficient to characterize it, and it is highly improbable that it

will ever be identified. There is a possibility that Larranaga refers to a naturalized form of *L. trichophyllum*, *L. longifolium* or *L. autumnale*, but we can never be certain on the basis of the description furnished.

Key to the subgenera and species of Genus. 2. LEUCOJUM

- 1a. Divisions of the perigone free (=tepals); leaves lorate or narrow-linear; epyginous disc lobed or not lobed; style strumose or filiform; plants vernal:
 - 2a Leaves lorate or narrow-linear; epigynous disc not lobed; style strumose in upper portion below apex:
 - 3a. Umbel 4- to 8-flowered, seeds with black crustaceous coats, (x=11)Subgenus 1. EULEUCOJUM
 - 4a. Leaves to 1.3 cm. wide (Central and southern Europe, from France to the Crimea and Armenia 1. *aestivum*
 - 4b. Leaves narrow-linear (Sardinia and Balearic Islands) 2. *pulchellum*
 - 3b. Umbel 1- to 2-flowered; seeds with pale membranous coats and conspicuous strophiole (x=11)Subgenus 2. ERINOSMA
 - Peduncle 2-edged, hollow (Central Europe, from Transylvania, Bosnia, the Tyrol to France) 3. *vernum*
 - 2b. Leaves narrow-linear; epigynous disc with 6 quadrate lobes at edge; style filiform (x=9)Subgenus 3. RUMINIA
 - Scape 1-flowered (France: Nice, Mentone and Villafranca) 4. *hyemale*
- 1b. Divisions of the perigone barely united at base (=tepaltube and telapsegs); leaves narrow-linear or filiform; epigynous disc not lobed; style filiform; plants vernal or autumnal (x=7, 8)Subgenus 4. ACIS
 - 5a. Leaves narrow-linear:
 - 6a. Umbel 5- or 6-flowered; scape 3—4.5 cm. tall (Morocco) 5. *tingitanum*
 - 6b. Umbel 4- or 5-flowered; scape 10—12 cm. tall (Morocco) 6. *Fontianum*
 - 5b. Leaves filiform:
 - 7a. Flowers rose-red, plants autumnal; umbel usually 1-flowered (Corsica) 7. *roseum*
 - 7b. Flowers white, cream or tinged with pink; plants autumnal or vernal:
 - 8a. Plants vernal; leaves up to 30 cm. long; umbel 1—4—flowered:
 - 9a. Leaves 2 or 3; umbel 1—3—flowered; tepalsegs 5-nerved (Corsica) 8. *longifolium*
 - 9b. Leaves 3; umbel 2—4—flowered; tepalsegs laxly 7-nerved (Spain, Portugal, Morocco and Algeria) 9. *trichophyllum*
 - 8b. Plants autumnal; leaves up to 22 cm. long; umbel 1—4—flowered:
 - 10a. Spathe 2-valved, flowers creamy white (Spain)10. *Valentinum*
 - 10b. Spathe usually 1-valved, rarely 2-valved; flowers white or tinged pink (Portugal, Morocco, Algeria, and the Ionian Islands)11. *autumnale*

Subgenus 1. EULEUCOJUM Benth. & Hook. f.

Gen. Pl. 3(II): 720. 1883; Baker, Amaryll. 19. 1888.

TYPE SPECIES.—*Leucojum aestivum* Linn.

DIAGNOSIS.—Epigynous disc not lobed; leaves lorate; spathe 1-valved; umbel 1- to 8-flowered; flowers vernal, white tipped with green; style strumose in upper portion below apex; seeds crustaceous, black, without a strophiole.

1. LEUCOJUM AESTIVUM Linn. Syst. ed. 10. 975. 1759; Smith & Sowerby, English Bot. ed. 1, vol. 9, pl. 621. 1799; Bot. Mag. t. 1210. 1809; Red. Lil. 3(23): pl. 135. 1805; Herbert, Amaryll. 332. 1837; Baker, Gard. Chron. i. 399. 1879; Amaryll. 19. 1888.

SYN.—*Leucojum autumnale* Gouan., Hort. Monsp. 163. 1768; *Nivaria aestivalis* Moench, Meth. 93. 1794; *Nivaria monadelphica* Medic., in Act. Acad. Theod. Palat. Phys. vi. 422. 1790.

DESCRIPTION.—Karyology, $2x=20-24$ (Heitz, 1926); $x=11$, $2x=22$ (La Cour, 1931, Nagao & Takusagawa, 1932); $2x=22$ (Sato, 1937, 1938; Inariyama, 1937; Neves, 1939). Bulb ovoid, 2.5—3.8 cm. in diameter; leaves lorate, obtuse, green, 3—4.5 dm. long, about 1.3 cm. broad; peduncle ancipitous, hollow, about 3 dm. tall; umbel 4- to 8-flowered; spathe 1-valved, lanceolate, 3.8—5 cm. long; pedicels long, cernuous; tepals broad-oblong 1.3—2 cm. long, white, tipped with green; stamens half as long as the tepals; anthers longer than filaments; style longer than stamens, green and slightly strumose towards the tip; capsule subglobose, 2 cm. in diameter; seeds with a thick black shining crustaceous coat.

RANGE.—Southern and central Europe and Asia Minor; from the Crimea and Armenia to France and Great Britain.

NOTES.—Flowers in Great Britain at end of April and beginning of May. A robust garden variety of *L. aestivum*, *Gravetye Giant*, produces from 6 to 8 large flowers to the umbel, and blooms during April and May in Northeastern United States but earlier in the Pacific Coast Region, and the South.

2. LEUCOJUM PULCHELLUM Salisb., Parad. Lond. t. 74. 1807 (errore *Leucoium*); Herbert, Amaryll. 332-333. 1837; Baker, Amaryll. 19. 1888.

SYN.—*Leucojum Hernandezii* Camb., in Mem. Mus. Par. xiv. 315. 1827; *Leucojum Hernandezianum* Schult. f., Syst. vii. 784.

DESCRIPTION.—Karyology, $2x=20-24$ (Heitz, 1926); $2x=22$ (Neves, 1939). Differs from *L. aestivum* by its smaller flowers and capsule and narrower leaves. It flowers two weeks earlier than *L. aestivum*.

RANGE.—Sardinia and Balearic Islands.

NOTES.—The description of Baker (1888) given above, is somewhat at variance with the type description of Salisbury (1807),—"Leaves appearing in November, of a deeper green and generally broader than in *L. aestivum*; very entire, quite smooth. Flowers smaller, from three weeks to a month earlier, exhaling a more perceptible and unpleasant smell. Peduncle the same color as the leaves, very entire at the edges,

not glaucous and crenulated as in *L. aestivum*. Pedicals from 3 to 7, slender and very long, of a dark green color, as well as the fruit. Petals white, with a green spot below the top, their nerves not so conspicuous Filaments white, anthers yellow, inserted at the base style white, with a green spot below the top, club-shaped. Stigma truncated, seeds 13—20 in a cell, black, oval, shining.”

Variety *majus* (Bailey, Cyclo. Hort. 1939, vol. 2, p. 1849) is reported as a selected large flowered form.

Subgenus 2. ERINOSMA (Herbert) Baker

Jour. Bot. 7: 166. 1878; Amaryll. 19. 1888.

SYN.—Genus *Erinosma* Herbert, Amaryll. 330. 1837.

TYPE SPECIES.—*Leucojum vernum* Linn.

DIAGNOSIS—Epigynous disc not lobed; leaves lorate; spathe 1-valved; umbel 1-flowered, rarely 2-flowered, flowers vernal, perigone white tipped with green or yellow; style strumose on the upper portion below the apex; seeds with pale crustaceous coats, and provided with a conspicuous strophiole.

3. LEUCOJUM VERNUM Linn. Sp. Pl. ed. 1. 289. 1753; Jacq. Austr. pl. 312. 1776; Curtis's Bot. Mag. pl. 46. 1788; Baker, Amaryll. 19. 1888.

SYN.—*Leucojum vernus* All. Fl. Pedem 2: 155 1785; *Nivaria hexanthera* Medic., in Act. Acad. Theod. Palat. Phys. 6: 422. 1790; *Nivara verna* Moench, Meth. 279. 1794; *Leucojum vernale* Salisb. Prod. 219. 1796; *Leucojum transsilvanicum* Porcius, Anal. Acad. Romane, ser. 2. 14: 274. 1893. (See also citations under var. *Vagneri*, below.)

DESCRIPTION.—Karyology: $x=12$, $2x=24$ (Overton, 1893); $ex=20$ (Heitz, 1926); $2x=22$ (Sato, 1937, 1938, Neves, 1939). Bulb globose, 2—2.5 cm. in diameter, outer tunics thin, pale green; leaves 3 or 4, lorate, 9—13 mm. (usually 7—8 mm.) broad, finally 1.5—2.3 dm. long; peduncle 2-edged, hollow, 1.5—3 dm. tall; umbel 1-flowered; spathe single, lanceolate; pedicel cernuus, about as long as the ovary; ovary turbinate; tepals white tipped with green, (or yellow?), broad-oblong, 2 cm. long; stamens half as long as the tepals; filaments much shorter than the anthers; style clavate below the apex; capsule green, turbinate, 1.3 cm. in diameter; seeds with a thin coat and small strophiole.

RANGE.—Central Europe; from Transylvania, Bosnia and the Tyrol to France.

NOTES.—Flowers in early March in Britain, according to Baker (1888).

3a. LEUCOJUM VERNUM L. var. VAGNERI Stapf, Schedae ad Flor. exs. Austro-Hung. 4: pl. 86, no. 1480. 1886; Baker, Amaryll. 19. 1888.

SYN.—*Erinosma carpathicum* Herb. Curtis's Bot. Mag. pl. 1993. 1818; Amaryll. 331. 1837; Czetz, Erd. Mus. Kolozsvárt, 6: 14.; Baker, Amaryll. 19. 1888; *Leucojum carpathicum* Steud. Nom. ed. II. 2:37. 1841; Salisb. Gen. Pl. Fragm. 96. 1866; *Leucojum vernum* L., Baumgarten, Enum. Transil. 1: 285. 1846; *Leucojum aestivum* Schur, Enum. Pl. Transsil. 658. 1866; Czetz, Erd. Mus. Kolozsvárt, 6: 16. non Linn.;

Leucojum biflorum Simonkai, Koezlem. 14: 135. 1879; *Leucojum vernum* L. var. *biflorum* (Simonkia)-Porcius, Anal. Acad. Romane, ser. 2. 14: 272-274. 1893.

DESCRIPTION.—Karyology: reported as “var. *carpathicum*,” $2x=22$ (Sato, 1937, 1938). Plant robust; leaves 1—1.6 cm. wide; umbel 2-flowered; otherwise similar to the type.

RANGE.—Transylvania, and Hungary.

NOTES.—*Erinosma carpathicum* Herb., included under synonyms above, is a form in which the tepals are tipped with yellow instead of green. The plant that is sometimes offered as “*Leucojum vernum* var. *carpathicum*” in the United States may be referable to *Leucojum vernum* var. *Vagneri*.

Subgenus 3. RUMINIA (Parlatore) Baker

Amaryll. 20-21. 1888.

SYN.—Genus *Ruminia* Parl., Due Nouv. Gen. Monocot. 3. 1854; Fl. Ital. 3: 84. 1858.

TYPE SPECIES.—*Leucojum hyemale* D. C.

DIAGNOSIS.—Epigynous disc with 6 lobes; leaves narrow-linear; spathe 2-valved; flowers vernal, usually solitary, white tinged with green; style filiform.

4. *LEUCOJUM HYEMALE* A. P. de Candolle, Flore Française, 5 (Tome) 327. 1815 (err. *Leucoium hiemale*); Baker, Bot. Mag. t. 6711. 1883; Amaryll. 20-21. 1888.

SYN.—*Leucojum autumnale* Balbis, Misc. Alt., Turin Acad. Sci. Mem. 1806, pp. 212-213, non Linn.; *Leucojum nicaeënse* Ardoino, Fl. Aples-Marit. 371. 1867; *Acis hiemalis* M. Roem. Syn. Ensat. 24. 1847; *Acis hyemalis* Sweet, Brit. Fl. Gard. 3: sub pl. 297. 1829; Herbert, Amaryll. 332. 1837; *Ruminia hyemalis* Parl., Due Nouv. Gen. Monocot. 3. 1854; Fl. Ital. 3: 84. 1858; *Ruminia nicaeënsis* Jord. et Fourr., Ic. Fl. Europe, 26. t. 65. f. 108. ; *Galanthus autumnalis* All. Auct. Fl. Pedem. 33. 1789.

DESCRIPTION.—Karyology, $2x=18$ (Neves, 1939). Bulb globose, 1.3 cm. in diameter, tunics brown; leaves 2 to 4, narrow-linear, contemporary with the flowers, finally 3 dm. long; peduncle 1-1.5 dm. tall; umbel usually 1-flowered; spathe 2-valved; pedicel short, cernuous; tepals 9-12 mm. long, white, tinged with green outside, oblong; anthers 5 mm. long, filaments scarcely any; ovary with the disc produced into 6 minute scales; capsule depressed-globose, 9 mm. in diameter.

RANGE.—France: Nice and Villafranca; coastal rocks.

NOTES.—Flowers in April, hence the name is misleading.

Subgenus 4. ACIS (Salisbury) Baker

Jour. Bot. 7: 166. 1878; Amaryll. 19-20. 1888.

SYN.—Genus *Acis* Salisb., Parad. Lond. sub t. 74. 1807; Gen. Pl. Fragm. 96. 1866; Herbert, Amaryll. 331-332. 1837.

TYPE SPECIES.—*Leucojum autumnale* Linn.

DIAGNOSIS.—Epigynous disc not lobed; leaves linear or filiform; spathe 2-valved; umbel 1- to 6-flowered, flowers vernal or autumnal, white, white tinged with red, or rose red; perigone-limb divided almost to base (= slight tepaltube plus tepalsegs); style filiform. Five recognized species.

5. *LEUCOJUM TINGITANUM* Baker, Jour. Linn. Soc. 16: 678. 1878, non *L. tigitanum* Font Quer; Baker, Amaryll. 20. 1888.

DESCRIPTION.—Karyology, no reports. Closely allied to *L. trichophyllum*; leaves narrow-linear, 3 dm. long, contemporary with the flowers; peduncle much stouter than in *L. trichophyllum*, 3-4.5 dm. tall; umbel 5- or 6-flowered; spathe-valves 2, lanceolate, membranous; tepalsegs white, 1.3-1.5 cm. long, oblanceolate; stamens 7 mm. long; filaments shorter than the anthers.

RANGE.—Morocco, vicinity of Tangier.

NOTES.—Vernal.

6. *LEUCOJUM FONTIANUM* Marie in Johandiez & Marie, Cat. Pl. Maroc. iii. 870. 1934.

SYN.—*Leucojum tigitanum* Font Quer in Cavanillesia v. 47-49. 1932 non *L. tigitanum* Baker.

DESCRIPTION.—Karyology, no reports. Bulbs ovoid-globose, tunics dusky-colored; leaves 4 or 5, appearing with the flowers, erect, thick, linear, almost flat, about 20 cm. long, 6-8 mm. wide at the base, 3-5 mm. wide toward apex, obtuse; scape shorter than the leaves, 10-12 cm. tall, flattened, 3-3.5 mm. thick; spathe-valves 2, membranous throughout, 2-2.5 cm. long, lanceolate-linear, rather obtuse, venose, white; umbel 4-flowered, pedicels very unequal, about 1 mm. thick, the longer ones 2.5-3 cm., and the shorter 6-10 mm. long; tepalsegs of the perigone 1.2-2.4 cm. long, setepalsegs obovate, 8-9 mm. broad, all mucronate and cucullate, white, unspotted; anthers 4 mm. long; filaments 1.5 mm. long; style slightly longer than the stamens, filiform, its apex not incrassate; ovary subglobose, 2.5-3 mm. in diameter.

RANGE.—Morocco: at the peak of Djebel Alam Mountain (Beni Aros, according to Moroccan maps) at 1400 meters altitude, in siliceous sandy soil.

NOTES.—Type material was collected after it had passed anthesis, May 7, 1930.

7. *LEUCOJUM ROSEUM* Martin, Bibl. Physic. 344. 1804; Loisel. Fl. Gall. ed. 1, 190. 1806; Reichenb. Ic. pl. 944-946. 1832; Pl. Crit. 8: pl. 704. 1830; Baker Amaryll. 20. 1888.

SYN.—*Acis rosea* Sweet, Brit. Fl. Gard. 3: pl. 297. 1829; *Acis roseus* Sweet ex Loud., Hort. Brit. suppl. 3: 432. 1850.

DESCRIPTION.—Karyology, $2x=16$ (Neves, 1939). Bulb globose, 6—13 mm. in diameter; tunics pale; leaves filiform, only one borne with the flowers, up to 5 produced after the flowers; peduncle very slender, 5—10 cm. tall; umbel usually 1-flowered; pedicels very short, cernuous; spathe 2-valved, valves small; tepalsegs 9 mm. long, rose red, oblanceolate; stamens 5 mm. long, filaments very short; capsule very small, globose.

RANGE.—Corsica; mountains.

NOTES.—Flowers in September and October.

8. *LEUCOJUM LONGIFOLIUM* J. Gay ex Salisb., in Flora, XVI. 491. 1833; Gren. & Godr., Fl. Fr. iii. 252. 1855; Baker, Amaryll. 20. 1888.

SYN.—*Acis longifolia* M. Roem., Syn. Ensatt. 25. 1847; Jord. et Fourr. Ic. t. 65, f. 107; *Leucojum trichophyllum* Reichenb., Ic. Pl. Crit. 8: pl. 703. 1830, non Schousb.

DESCRIPTION.—Karyology, no reports. Bulb ovoid, 1.3 cm. in diameter, tunics thin, pale brown; leaves 2 or 3, filiform, very slender, flaccid, longer than the peduncle, 1.5—3 dm. long; peduncle very slender, 7.6—15 cm. tall; umbel 1- to 3-flowered; spathe-valves 2, linear; pedicels short; tepalsegs white, 6—9 mm. long, oblanceolate, 5-nerved; stamens 4 mm. long; filaments very short.

RANGE.—Corsica; on mountains at altitudes, 4500—6000 ft.

NOTES.—Flowers in April and May.

9. *LEUCOJUM TRICHOPHYLLUM* Schousboe, Vextr. Morokko 1: 154. 1800; Ker-Gawl. Bot. Reg. 7: pl. 544. 1821; Baker, Amaryll. 19. 1888; Dur. & Schinz, Consp. Fl. Afr. 5: 242. 1893.

SYN.—*Acis trichophylla* Sweet, Brit. Fl. Gard. 3: sub pl. 297. 1829; *Acis Broteri* Jord. & Fourr., Ic. Pl. Europe, 25, pl. 64, fig. 105.

DESCRIPTION.—Karyology, $2x=14$, (Neves, 1939). Bulb ovoid, 1.3-2 cm. in diameter, tunics pale brown; leaves about 3, filiform, as long as the peduncle, contemporary with the flowers; peduncle very slender, 1.5-3 dm. tall; umbel 2- to 4-flowered; spathe-valves 2, lanceolate; pedicel long, cernuous; tepalsegs white, 1.3-2 cm. long, rarely 2-2.5 cm. long, oblanceolate-oblong, laxly 7-nerved; stamens 4 mm. long; filaments very short; capsule turbinate, 9 mm. long.

RANGE.—Spain, Portugal, Morocco and Algiers.

9a. *LEUCOJUM TRICHOPHYLLUM* Schousboe var. *GRANDIFLORUM* (P. DC.) Baker, Amaryll. 19. 1888; Dur. & Schinz, Consp. Fl. Afr. 5: 242. 1893.

SYN.—*Leucojum grandiflorum* P. DC. in Red. Lil. 4(37): pl. 217. 1808; *Acis grandiflora* Sweet, Brit. Fl. Gard. 3: sub pl. 297. 1829; *Acis grandiflora* Herb. Amaryll. 332, pl. 30, fig. 4, 1837.

DESCRIPTION.—Tepalsegs 2-2.5 cm. long.

10. *LEUCOJUM VALENTINUM* Pau, in Boletin Soc. Argonesa Cien. Nat. 13: 42. 1914; C. H. Grey, Hardy Bulbs, 2: 56; 1938.

Description.—Karyology: no reports. Leaves filiform, appearing after the flowers; scape 10 cm. tall, somewhat twisted, striate; spathe 2-valved; umbel 1- to 3-flowered; pedicels unequal, longer than the milk-white flowers; petepals 7 mm. x 11 mm., elliptic-oblong and obtuse; setepals oblong or broadly linear and mucronate, 5 mm. x 14 mm.; disk epigynous; with green lobes about the length of the filaments; style filiform.

Range.—Spain; eastern foothills, Sierra de Espadan (Beltram).

Notes.—Flowers in August to September. According to Pau, who

based his description on living and dried specimens, this species differs from *L. autumnale* particularly with reference to the stamens.

According to Pau (1938), this species belongs in the subgenus *Ruminia*. This conclusion is apparently based on the presence of an epigynous disk "with green lobes about the length of the filaments."

Col. Grey (1938) describes the species as follows: "Leaves filiform, developed after flowering; scape more or less twisted, striate, 1-1.3 dm. long; spathe-valves 2; umbel 1- to 3-flowered; flowers cream white; pedicels cernuous, unequal in length, always longer than the flowers; setepalsegs broadly linear, mucronate, more than 2.5 cm. long; petepalsegs oblong-elliptic, obtuse, somewhat shorter; anthers green, as long as the filaments. Col. Grey (1938) observes, "apart from its two spathe-valves and large stamens, [it] is very close to *L. autumnale*".

11. *Leucojum autumnale* Linn. Sp. Pl. ed. I. 289. 1753; Bot. Mag. t. 960. 1806; Salisb. Parad. Lond. t. 21. 1806; Baker, Amaryll. 20. 1888; Dur. & Schinz, Consp. Fl. Afr. 5: 242. 1893.

Syn.—*Leucoium auctumnale* J. F. Gmel. Syst. Nat., 2: 534. 1791; *Leucojum vernum* Guelddenst., Reisen Russl. 1: 149. 1787, non Linn.; *Acis autumnalis* (combination implied) Salisb. Parad. Lond. sub t. 74, 1807; *Acis oporantha* Jord. et Fourr. Brev. Pl. Nov. fasc. 1. 51. 1866; *Acis cephalonica* J. Gay (cited by Baker, Amaryll. 20. 1888).

Description.—Karyology, $2x=14$ (Heitz, 1926; Sato, 1937, 1938; Neves, 1939). Bulb globose, 1.3 cm. in diameter, tunic thin, pale brown, neck of bulb up to 2.5-5 cm. long; leaves filiform, very slender, usually produced after the flowers; peduncle very slender, 7.6-23 cm. tall; umbel 1- to 3-flowered; spathe 1-valved; pedicels longer than the spathe, cernuous; tepalsegs 9-13 mm. long, white tinged with red, oblanceolate-oblong, laxly 5- to 7-nerved; stamens half as long as the tepals; filaments very short; capsule globose, 5 mm. in diameter.

Range.—Portugal and Morocco to the Ionian Islands.

Notes.—Flowers in autumn.

Acis oporantha Jord. & Fourr. (cited as a synonym above), native to western Spain, around Naval-Maral, has a 2-flowered umbel; and *Acis cephalonica* J. Gay (cited as a synonym above) has a 2-valved spathe.

11a. *Leucojum autumnale* Linn. var. *pulchellum* Durand & Schinz. Consp. Fl. Afr. 5: 242. 1893.

Syn.—*Acis pulchella* Jord. et Fourr., Brev. Pl. Nov. fasc. 1, p. 51. 1866; Baker, Amaryll. 20. 1888.

Description.—Karyology, no reports. Leaves filiform, appearing with the flowers, shorter than the scape; peduncle reddish; umbel 2-flowered; pedicels erect, slightly curved at the apex; spathe rather long; flowers white, shading to rosy at the base, pendulous; tepalsegs elliptic-oblong; setepalsegs slightly 3-toothed; petepalsegs acute; stamens half as long as the perigone; style longer than the stamens; capsule subglobose, truncate on top.

Range.—Algeria; Daroussa near Bone.

Notes.—Collected by the Rev. A. Joannon. Jordan & Fourreau (1866) state that the plant is noteworthy because of its relatively large flowers that are rosy toward the base, the truly pendulous flowers, and the leaves which appear with the flowers.

For the past several years, the senior author has been growing a plant that is apparently referable to *L. autumnale* var. *pulchellum*. When first grown out of doors in Monterey County, California in 1944, it flowered in late summer-autumn, the leaves appearing with the flowers. The umbel was 2-flowered. The plant was without leaves in summer. However, when grown as a pot-plant in Maryland (8 small bulbs evenly spaced in an 8-inch pot), it multiplied rapidly and proved to be evergreen, and practically everblooming when supplied with an abundance of moisture and fertilizer ("Vigoro"). It multiplied so rapidly that there was decided overcrowding within two years so that it was best to start anew with 8 small bulbs in an 8-inch pot.

Under out-door culture the original description of Jordan and Fourreau fitted in most particulars, but under pot-culture as indicated above, the original description needed emendation in certain particulars. This shows the effect of environmental conditions on plant species: in pot culture (1) the leaves vary from (a) filiform (thread-like) to (b) channeled on top, 0.75 mm. x 1.5 mm. in the lower part, and tapering to filiform near the tip; (2) the umbel is 2- to 4-flowered, usually 2- to 3-flowered, rarely 4-flowered; (3) the spathe is 1- to 2-valved; (4) the flowers are relatively larger; (5) the stamens are less than half as long as the perigone; and (6) the tepals are 3-dentate, but in case of the setepals, the central tooth (= mucronate) is somewhat longer than the other two; and in case of the petepals, the teeth are more or less equal.

The seeds were not described by Jordan and Fourreau. As grown under pot culture, the globose, black seeds average about 1.5 mm. x 2 mm.

Since *Leucojum autumnale* var. *pulchellum* is practically everblooming under pot-culture, the senior author was able to transfer pollen from *Leucojum aestivum* to the stigmas of the former in spring when both were in flower. In all of the many attempts, the ovules were apparently fertilized for they began development, but later the ovules aborted. This opens up the possibility of culturing the recently fertilized ovules on sterile media and thus to obtain hybrid individuals. In this way the slight rose color of variety *pulchellum*, and possibly also the deeper rose color of *L. roseum*, may be transferred to a race of large-flowered hybrids.

The fact that the species with a slight tepaltube (subgenus *Acis*) do not cross in nature with large-flowering species lacking the tepaltube, apparently indicates that Salisbury was essentially correct in giving the former group generic rank. The presence of the tepaltube is a sufficient morphological difference for generic distinction. However, for the present the subgenus *Acis* is retained under *Leucojum*.

THE GENUS GALANTHUS

Although the species of *Galanthus* are porandrous, shedding pollen through terminal pores as in *Leucojum*, they have evolved in a different direction with respect to the tepals which have become dimorphic—the petepals are distinctly smaller than the setepals. However, with respect to some other characters the *Galanthus* species are relatively primitive in having a filiform style, and no tepaltube.

Linnaeus included the genus *Galanthus* in *Species Plantarum* (1753) on the basis of a single species, *Galanthus nivalis* Linn. Bieberstein (1819) recognized a second species, *Galanthus plicatus* Bieb. Ruprecht (1868) proposed a species under the name, *Galanthus latifolius* Rupr., which however is a later homonym for *Galanthus latifolius* Salisb., a synonym of *Galanthus plicatus* Bieb., was validly published in 1866. Ruprecht's species is obviously without a name (cf. species no. 11. *Galanthus platyphyllus*, below). Boissier (1884) added two species, *Galanthus graecus* Orph. ex Boiss., and *Galanthus Olgae* Orph. ex Boiss. Hooker f. (1875) proposed a sixth species, *Galanthus Elwesii* Hook. f. Baker (1888) recognized the six above mentioned species, but since the appearance of his work in 1888, thirteen additional species have been proposed. It should be realized that after a more thorough study a large proportion of these may prove to be untenable. Baker, who proposed seven species since 1888, admits that three of these—*G. Perryi* Baker, *G. Alleni* Baker, and *G. grandiflorus* Baker—may be natural hybrids. In the present work, nineteen species, including the six proposed before 1888, are admitted tentatively pending a more thorough investigation of the subject that is urgently needed.

Genus 3. GALANTHUS Linnaeus

Sp. Pl. ed. 1. 288. 1753; Gen. Pl. ed. 5. 140. 1754; Herbert, Amaryll. 329-330. 1837; Bentham & Hooker f., Gen. Pl. 3(2): 719. 1883; Pax, Engl. & Prantl. Nat. Pflanzefam. ed. 1. 2(5): 105. 1887; Baker, Amaryll. 16-18. 1888; Pax & Hoffman, Engl. & Prantl, Nat. Pflanzenfam. ed. 2. 15a: 403-404. 1930.

SYN.—*Acrocorion* Adan., Fam. Pl. 2: 57. 1763; *Aerokorion* Scop., Ann. IV. Hist. Nat. 96. 1770; *Galactanthus* Lem., in Orb. Dict. 5: 763. 1849.

TYPE SPECIES.—*Galanthus nivalis* Linn.

DIAGNOSIS.—Karyology: inadequately investigated, $x=7, 10, 12$. Rootstock a tunicated bulb, one tunic wrapped tightly around the base of the stem and leaves; leaves 2 or 3, lorate; peduncle solid; spathe usually monophyllous, very rarely 2-valved; umbel usually 1-flowered, very rarely 2-flowered; pedicels cernuous; perigone dimorphic, tepals 6, petepals smaller than the setepals, tepaltube absent; tepals white, or white and green; petepals very rarely tipped with yellow; setepals oblong-spatulate, petepals much shorter, obovate, emarginate, stiffly erect; stamens 6, epigynous, porandrous; filaments very short; anthers basifixed, lanceolate, usually acuminate, hidden in the petepals; ovary inferior, globose, 3-celled; ovules many in a cell, superposed; style fili-

form, longer than the stamens; stigma capitate, minute; fruit a capsule, finally loculicidally 3-valved; seeds ellipsoid, strophiolate, coats pale, thin. Nineteen species including some that are tentatively recognized.

KARYOLOGY AND CLASSIFICATION

The number of species recognized has now increased to such an extent that it is advisable to make an attempt to group them on the basis of apparent evolutionary tendencies as shown by the karyology and gross morphology. Unfortunately, the karyology of the genus *Galanthus* has not been as extensively investigated as in the case of the genus *Leucojum* for only three closely related species out of a total of eighteen have received attention from this standpoint. Complete data with citations, if any, to the karyology are given under the respective species. Data showing the entire range of the chromosome complements for the three species about which such data is available are summarized in the following table:

Genus and probable basic or x numbers; and species	2x ¹	Authors
<i>Galanthus</i> x=7, 10, 12		
<i>nivalis</i> Linn.	20, 24 24, 25, 28	Transkowsky (1930) Sato (1937, 1938)
<i>cicilicus</i> Baker	24	Heitz (1926)
<i>Elwesii</i> Hook. f.	24, 48	Sato (1937, 1938)

On the basis of this limited data, it is not possible to arrive at any profound correlations between the karyological findings and the gross morphological characters. Any present classification must therefore still be based mainly on the latter foundation.

According to Boissier (1884), who recognized six species, there are two main groups. In one, with only *G. latifolius* (cf. species no. 11, *G. platyphyllus*, below), the anthers are oblong and not appendiculated, and in the second group, representing the remainder, the anthers are prolonged at the top into an apiculus. Baker (Gard. Chron. 9: 298. 1891) questioned the validity of this criterion as the basis for classification because it is sometimes applicable and sometimes not (in *G. Alleni* Baker, for instance). However, *G. Alleni* is suspect as a natural hybrid. Only further extensive study can settle this point.

It should be noted that the species centering around *Galanthus nivalis* Linn. as the biological type have leaves that are simply channeled down the face and are without reduplicate edges, whereas those centering around *Galanthus plicatus* Bieb., have leaves broadly channeled

¹ Either observed directly, or calculated from observations of meiosis in pollen or pollen mother cells.

down the face and are with reduplicate edges. These evolutionary tendencies in the group appear to be the only ones discerned so far that are of sufficient importance for use as the basis of subgeneric groupings.

Key to the subgenera and species of Genus 3. GALANTHUS

- 1a. Leaves simply channeled down the faceSubgenus 1. EUGALANTHUS
 - 2a. Leaves 6 to 10 mm. broad:
 - 3a. Plants vernal:
 - 4a. Scape 2-edged (southern and central Europe to Caucasus)1. *nivalis*
 - 4b. Scape subterete, plant smaller in all its parts (Bulgaria and Romania)2. *gracilis*
 - 3b. Plants autumnal (Greece)3. *Olgae*
 - 2b. Leaves 1.2 to 2.5 cm. broad:
 - 5a. Leaves variously glaucous in color:
 - 6a. Leaves very glaucous, except green in *G. caucasicus* var. *caspius*; scape up to 1.5 dm. tall:
 - 7a. Setepals oblong-spatulate, 2—3.2 cm. long, and 1.3—2 cm. broad (Asia Minor)4. *Elwesii*
 - 7b. Setepals shorter and narrower than in *G. Elwesii* (Isle of Choïs)5. *graecus*
 - 7c. Setepals obovate-unguiculate (Caucasus)6. *caucasicus*
 - 6b. Leaves moderately glaucous, scape 1.5—2 dm. tall (Bulgaria)7. *maximus*
 - 6c. Leaves only slightly glaucous, scape 5 cm. tall (Caucasus)3. *Perryi*
 - 5b. Leaves not glaucous, dull or bright green in color:
 - 8a. Leaves dull green:
 - 9a. Petepals $\frac{1}{2}$ as long as setepals (Caucasus)9. *Alleni*
 - 9b. Petepals $\frac{2}{3}$ as long as setepals (Caucasus)10. *transcaucasicus*
 - 8b. Leaves bright green:
 - 10a. Leaves 2—2.5 cm. broad; spathe without reflexed edges:
 - 11a. Stamens $\frac{3}{4}$ as long as petepals (Caucasus)11. *platyphyllus*
 - 11b. Stamens not more than $\frac{1}{2}$ as long as the petepals (North-central Asia Minor)12. *Fosteri*
 - 10b. Leaves 1.3—1.5 broad, spathe without reflexed edges; or, when 1.8—2 cm. broad, then spathe with reflexed edges:
 - 12a. Scape 1.3—1.5 dm. tall; setepals oblong, concave on the face (Asia Minor)13. *cicilicus*
 - 12b. Scape 1.8—2 dm. tall; setepals oblong-spatulate (Isle of Nikaria)14. *Ikariae*
- 1b. Edges of leaves reduplicateSubgenus 2. PLICATANTHUS
 - 13a. Leaves up to 9 cm. long (Caucasus)15. *alpinus*
 - 13b. Leaves from 1.5 to 5 dm. long:
 - 14a. Petepals marked with green at top only:
 - 15a. Leaves glaucous:
 - 16a. Petepals green on upper half, with a white edge (Crimea and Dobruja)16. *plicatus*
 - 16b. Petepals green on almost half of upper part, without a white edge (Habitat unknown)17. *grandiflorus*

- 15b. Leaves yellowish-green (Transcaucasia) 18. *Woronowii*
 14a. Petepals marked with green at top and on lower part
 of back (Southeastern Europe) 19. *byzantinus*

Subgenus 1. **EUGALANTHUS** Traub & Moldenke, **subg. nov.**

Folia tantummodo supra canaliculata, marginibus non reduplicatis, subglauca usque ad glaucissima, vel colore claro-viridia usque ad obscuro-viridia. Species typica—*Galanthus nivalis* Linn.

DIAGNOSIS.—Leaves simply channeled down the face, not reduplicate at the edges; slightly glaucous to very glaucous, or bright to dull green in color.

TYPE SPECIES.—*Galanthus nivalis* Linn.

1. *GALANTHUS NIVALIS* Linnaeus, Sp. Pl. ed. I. 288. 1753; Smith & Sowerby, English Bot. ed. 1, vol. 1, pl. 19, 1790; Redouté, Lil. 4 (34) : pl. 200. 1807; Herbert, Amaryll. 330. 1837; Baker, Amaryll. 16-17. 1888.

SYN.—*Galanthus Clusii* Alloni, Auct. Fl. Pedem. 33. 1785; *Galanthus montana* (= *montanus*) Schur, Enum. Pl. Transsilv. 658. 1866; *Galanthus plicatus* Hohen., Pl. Elisazethpol, 228. 1833; *Galanthus reflexus* Herb. ex. Lindl., Bot. Reg. 31: Misc. 44. 1845; *Galanthus corcyrensis* Leicht. ex. Le Jardin, 139. 1888; *Galanthus Sharlocki* Casp. ex Gard. Chron. i. 243. 1888; *Galanthus Sharloki* (Casp.) ex Baker, Amaryll. 17. 1888; *Galanthus umbricus* Dammann, Cat. 4. 1889; *Galanthus plicatus* Guss., Pl. Rar. 140. 1826, non Salisb., non Bieb., non Hohen.; *Galanthus Alexandrii* Porcius, Anal. Acad. Romane, Ser. 2. 14: 274. 1893; *Galanthus octobrensis* Hort. ex Vilmorin's Blumeng. ed. 3. Sieb. & Voss. i. 1006. 1895. (See also Subsp. 1. *Imperati* (Bertol.) Baker, below, and synonyms under it.)

DESCRIPTION.—Karyology, $x=12$ (Stenar, 1925, Perry, 1932); $x=10$, 12 (Transkowsky, 1930); $2x=24$ (Heitz, 1926); $2x=24$, 25, 28 (Sato, 1937, 1938). Bulb globose, 1.3-2.5 cm. in diameter; basal sheath truncate, 5-7.6 cm. long, slit down one side; leaves linear, glaucous, finally 1.5-2.3 dm. long, 6-9 mm. broad, simply channeled down the face; peduncle 7.6-15 cm. tall; spathe green, with hyaline edge; setepals oblong, 1.3-2.5 cm. long; petepals half as long, obovate-cuneate, deeply emarginate, with only a green patch around the sinus; anthers lanceolate, 7 mm. long, gradually acuminate.

RANGE.—Widely distributed through southern and central Europe, from the Pyrenees to the Caucasus.

NOTES.—Flowers in February and March. *Galanthus reflexus* Herb., from Mt. Gargarus, cited under synonyms above, has much smaller flowers than the type, and petepals are reflexed at apex; *Galanthus corcyrensis* Leicht. ex Le Jardin, cited above, (var. *praecox*) from Corfu, flowers in December; *Galanthus octobrensis* Hort. ex Vilmorin, flowers in England at the end of October; *Galanthus nivalis* var. *lutescens* Hort. (Baker, Amaryll. 17. 1888), has a yellowish ovary, and petepals tipped with yellow instead of green; var. *poculiformis* Hort. (Baker, l. c.) has petepals plain white in color, and nearly as long as the setepals; *Galanthus Sharlocki* Casp., cited under synonyms above, has two long, herbaceous spathe-

valves; sometimes a 2-flowered umbel, and setepals with a green spot at the tip. *Galanthus viridi-apice* Hort. ex Van Tubergen (C. H. Grey, Hardy Bulbs 2: 32. 1938) with large flowers, tepals deeply green-margined, and flowering from February to March, may be a form of *Galanthus nivalis*. Herbert (Amaryll. 330. 1837) lists *G. nivalis* var. *hortensis* Herb., having "Flowers semi-double; with a more or less perfect anther in some of the flowers." A double garden variety of *G. nivalis*, under the name, *Galanthus plenus*, is available in the trade at the present time. *Galanthus Atkinsii* Hort. (The Garden, vol. 74, page 154.) is apparently a garden variety of *Galanthus nivalis*.

1a. GALANTHUS NIVALIS subspecies 1. IMPERATI (Bertol.) Baker, Amaryll. 17. 1888.

SYN.—*Galanthus Imperati* Bertol. Fl. It 1. 4: 5. 1839; *Galanthus plicatus* Tenore, non Bieb.; *Galanthus Clusii* Fisch. ex Steud. Nom. ed. 2. 1: 653. 1840; *Galanthus Melvillei* Hort. ex Vilmorin's Blumeng. ed. 3. Sieb. & Voss. 1: 1006. 1895.

DESCRIPTION.—Karyology, no reports. Leaves broader than in the type, and flowers larger; setepals 2.5-3.2 cm. long, more spatulate and narrower at base than in type.

RANGE.—Italy: Naples and Genova.

2. GALANTHUS GRACILIS Celakovsky, in Sitz. Boehm, Ges. Wiss. i. 195, t. 9. 1891; Fl. Bulg. 539. 1891.

SYN.—*Galanthus bulgaricus* Velen., Fl. Bulg. 539. 1891, in synon.

DESCRIPTION.—Karyology; no reports. Bulb oval, basal sheath truncate, entire, rarely shortly split; leaves appearing with the flowers, linear-cuneate, finally broader, subcucullate at apex, narrowed into a sheath at base, upper surface channeled, keeled with a slender simple midrib, glaucescent-pruinose; scape slender, subterete, somewhat flattened toward the base, with rounded edges, not distinctly 2-edged, subequaling or slightly exceeding the leaves; spathe narrow, thin; ovary subglobose or oval-globose; setepals white, oval or oblong, concave, narrowed at the base; petepals $\frac{1}{2}$ to $\frac{1}{3}$ as long as the setepals, oblong-cuneate, more deeply split at the apex with an acute sinus, the outer surface green on the lower half or beyond, above this marked with two green spots, rarely rather clearly transversely zonate, the inner surface plicate-nerved with 6-8 narrow green nerves of which 4 are longer than the others, their lobes subquadrate, subtruncate, entire, slightly recurved at the margin; anthers yellow, not saffron-colored, almost three times as long as the filaments, distinctly widened at the base, cordate-emarginate, abruptly attenuate at the apex, produced into a subulate tip.

RANGE.—Bulgaria and Romania (Ostrumelien).

NOTES.—Flowers in February and March.

Galanthus gracilis is described as one of the finest species, but apparently is not widely known in cultivation. It differs from *G. nivalis* in a number of characters, including among others, a less robust habit, being usually significantly smaller in all its parts, a more slender, not sharply 2-edged scape; and leaves with a keel composed of only one nerve.

According to Baker (Gard. Chron. 13 (1): 656. 1893), *G. gracilis*

“is very nearly allied to *G. Elwesii*, being similar in stature, and in having a large blotch at the base of the inner segments of the perianth, of which, however, the apical lobes are oblong, and not at all crisped at the edge. It appears to be widely spread in Bulgaria.”

3. *GALANTHUS OLGAE* Orphanides ex Boissier, Fl. Orient. 5: 146. 1884; Baker, Amaryll. 18. 1888.

SYN.—*Galanthus Algae-Reginae* Hort. ex Gard. & For. 1: 499. 1888; *Galanthus Reginae-Olgae* Hort. ex Le Jardin, 140. 1888.

DESCRIPTION.—Karyology, no reports. Sheath radical, truncate, laterally and shortly split at the apex; leaves 2, produced after the flowers, elongate, linear, obtuse (in the dry state), rather flat, very glaucous beneath, 15-20 cm. long, about 6 mm. wide; scape somewhat longer than the leaves; flowers drooping, rather large, white; setepals elongate-elliptic, obtuse, narrowed into a claw, 2.5 cm. long, 6-7 mm. wide, petepals half as long, cuneate, longitudinally many-lined, shortly obcordate, with rounded lobes, in the dry state apparently not green-spotted; stamens $2/5$ as long as the petepals; anthers long-subulate-acuminate; filaments very short.

RANGE.—Greece: Taygeto Mountain.

NOTES.—Flowers in October, and is especially notable on that account.

5. *GALANTHUS GRAECUS* Orphanides ex Boissier, Pl. Orient. 5: 145. 1884; Baker, Amaryll. 17. 1888.

DESCRIPTION.—Karyology, no reports. Sheath radical, truncate and laterally split at the apex; leaves 2, appearing with the flowers, rather broadly linear, channeled, obtuse, glaucous, 6-10 mm. broad; scape slightly shorter than the leaves, slightly compressed; flower pendulous, setepals white, oblong-elliptic, concave, attenuate at the base; petepals half as long, obovate, the lower part green, the apex very shortly and obtusely bilobed and with 2 green spots; stamens $3/4$ as long as the petepals; anthers 4 to 5 times as long as the filaments, slightly winged-appendaged (appendiculate) at the apex.

RANGE.—Greece: upper region of Mount Pellinos on the Island of Chios, altitude 1,158 meters.

NOTES.—Flowers in April. Boissier observes that the flower is “of the size of *Galanthus nivalis*, almost intermediate between it and *Galanthus Elwesii*, differing from *G. nivalis* in the interior divisions [petepals] being less cuneate, less deeply bilobed, and the lower portion green not white, from *G. Elwesii* in the smaller flower, the exterior divisions (setepals) being narrower and the lobes of the interior divisions [petepals] not quadrate nor undulate-crisped.”

4. *GALANTHUS ELWESII* Hook. f., Bot. Mag. t. 6166. 1875; Baker, Amaryll. 17. 1888.

SYN.—*Galanthus globosus* Wilks, in Garden i. 393. 1887.

DESCRIPTION.—Karyology: type, $2x=24$ (Heitz, 1926), $2x=24$, 48 (Sato, 1937, 1938); var. *robustus*, $2x=24$, var. *praecox*, $2x=24$, (Heitz, 1926). Bulb globose, larger than in *G. nivalis*, 2 cm. in diam., tunics thick, fleshy; sheath membranous, mouth oblique and cleft on one side, 2.5-7.6 cm. long; leaves 2, simply channeled down the face, 1.5-2 dm. long, (broader than in *G. nivalis*) 2 cm. broad, obtuse, not plaited but always

twisted, very glaucous, sheathing the base of the peduncle; scape 1.5 dm. tall, oblong on transverse section; spathe single, 2.5-5 cm. long, convolute, border membranous; ovary obovoid, 1.3 cm. long; perigone 3.8 cm. in diameter or more when spread out; setepals white, broadly obovate, obtuse, concave (oblong-spatulate), 2-3.2 cm. long, 1.3-2 cm. broad; petepals oblong-cuneate, constricted somewhat above the middle, 2-lobed at tip, the lobes obliquely truncate and spreading, green, with a white wrinkled border and a broad white horizontal band above the middle, the outer surface smooth, the inner deeply ribbed; filaments very short; anthers 7 mm. long, narrowed gradually from the base to apex, and with long prolongations and subulate recurved tips; capsule turbinate.

RANGE.—Asia Minor; mts., alt. 610-1548 m.

NOTES.—Flowers in February. Hooker f. (1875) observes, that *Galanthus Elwesii* “is a native of the summits of Yamanlardagh mountains, north of the Gulf of Smyrna, where it was discovered by M. Balansa in 1854, and whence dried specimens were distributed under the name of *G. plicatus*, being so named by M. J. Gay of Paris. I am indebted to Mr. Elwes . . . for pointing out its distinctive character from *G. plicatus*, and which Mr. Baker has confirmed.” The form, *G. globosus* Wilks, cited as a synonym above, has globose flowers, setepals very broad, and the umbel is often 2-flowered. Miller and Taylor (Bailey, Cyclo. Hort. 1939, vol. 2, p. 1309) list the following as varieties of *G. Elwesii*—var. *Cassaba*, var. *ochrospilus*, var. *unguiculatus*, var. *Erithrae*, var. *Whittallii*, and var. *robustus*.

6. *GALANTHUS CAUCASICUS* (Baker) Grossheim, in Grossheim & Schischk., Shed. Herb. Pl. Or. Exsicc. 4. 1924; et Fl. Caucasia 1: 244. 1928.

SYN.—*Galanthus Redoutei* von Ruprecht ex E. Rupr., in Regel, Gartenfl. 12: 177-178, in synonym. 1863; *Galanthus nivalis* var. *Redoutei* (von Ruprecht ex E. Rupr.) E. Rupr., in Regel, Gartenfl. 12: pl. 400, fig. 2. 1863; et Trans. Russ. Hort. Soc. pl. 126. 1863; in Regel, Gartenfl. 23: 202. 1874; *Galanthus nivalis* var. *major* E. Rupr., in Regel, Gartenfl. 17: 130-133. 1868, except reference to Redouté, Lil., pl. 200; *Galanthus nivalis* var. *caspius* E. Rupr., in Regel, Gartenfl. 17: 133. 1868; *Galanthus nivalis* var. *Redoutei* Bossier, Fl. Orient. 5: 144-145. 1884, except reference to Redouté, Lil., pl. 200; *Galanthus nivalis* subsp. *caucasicus* Baker, Gard. Chron. (1): 313. 1887 [type description]; Amaryll. 16. 1888; *Galanthus nivalis* var. *virescens* Baker, Amaryll. 17. 1888.

TYPE: Plate 400, fig. 2, in Regel, Gartenfl. 12: 1863.

DESCRIPTION.—Karyology: no reports. Bulb globose, 1.3 cm. in diam.; tunics many, brown, membranous; leaf-sheath cylindrical, membranous, 2.5-5 cm. long, truncate at the apex; leaves lorate, more glaucous than in *G. nivalis* (green in var. *caspius*), 1.3 cm. broad, simply channeled down the face, shorter than the peduncle when it begins to flower, but finally as long; peduncle very glaucous, 7.6-15 cm. long; spathe usually simple, rarely bifid; pedicel cernuous, shorter than the spathe; ovary green, turbinate, vertically plicate; setepals pure white, obovate-unguiculate, broader, more convex on the back, and with a narrower claw than in *G. nivalis*, 2-2.5 cm. long; petepals half as long, obovate-cuneate, with a

deep notch and two erect rounded lobes, only marked with green on the outside in a horseshoe-shaped patch around the notch, but within streaked with green and white more than half-way down; anthers deep orange, narrowed gradually from the cordate base to the apex; filaments very short, white.

RANGE.—Caucasus.

NOTES.—According to E. Ruprecht (1863), this species was introduced from the Caucasus by von Ruprecht, a member of the St. Petersburg Academy, to the St. Petersburg Garden Society prior to 1863, under the name *Galanthus Redoutei*. E. Ruprecht supposed that the Academy member, von Ruprecht, did so in allusion to plate 200 in Redouté's *Liliacees*, a plate which refers to *Galanthus nivalis*, but it should be noted that this is only a supposition.

E. Ruprecht (1863) described the plant under consideration under the names *Galanthus Redoutei*, and *G. nivalis* var. *Redoutei*, but included the former in the synonymy of the latter, and thus accepted the latter name. However, in 1868, he listed under *Galanthus nivalis* the two varieties "major Redoute" and "caspius Ruprecht." The former apparently is supposed to represent the plant indicated as *G. Redoutei* and *G. nivalis* var. *Redoutei* in 1863. Later (Regel, *Gartenfl.* 23: 202. 1874), however, he states that *Galanthus Redoutei* or *G. nivalis* var. *Redoutei*, often blooms 3 to 6 days before *G. nivalis*, the leaves are larger and broader than the type, but a distinctive character on which to base a species is lacking. In order that we may understand E. Ruprecht's viewpoint in 1868, it is of interest to consider his descriptions,—

Galanthus nivalis var. *Redoutei* (syn.—*Galanthus Redoutei*), with type illustration, pl. 400, fig. 2, in Regel, *Gartenfl.* 12: 177-178. 1863. The description is very brief: "Leaves broader, shorter and more glaucous than in the typical *G. nivalis*; flowers somewhat smaller."

Galanthus nivalis Linn. the type, according to Ruprecht (1868): Bulb subovoid, not agglomerate; leaves not revolute at margin, linear, rarely almost lanceolate, mostly slightly glaucescent, 4-8 mm. wide; scape 5-15 cm. tall; outer petals [setepals] 1-2 cm. long, $\frac{1}{3}$ to $\frac{2}{5}$ as wide: ovary cylindric-oblong or ovate."

Galanthus nivalis var. *major* Redoute ex Ruprecht (1868): "Larger in all its parts than the typical plant; bulb subglobose; leaves intensely glaucous, oblong, 8-12 mm. wide, firm; scape sometimes 30 cm. tall; outer petals [setepals] especially broader, 1.8-2 cm. long, $\frac{1}{2}$ to $\frac{1}{3}$ as wide."

Galanthus nivalis var. *caspius* Ruprecht (1868): "Almost 30 cm. tall, flaccid; leaves 8-12 mm. broad, almost linear (in the dried state). green, equaling or surpassing the flowering scape."

The above descriptions indicate that the differences are apparently mainly in size of plant parts, and degree of the glaucous character of the leaves, and thus bear out E. Ruprecht's final conclusion. However, Baker (1887) proposed *G. nivalis* subsp. *caucasicus* Baker, and described it (in Baker, *Amaryll.* 17. 1888) as "Leaves broader than in the type, finally 20-22 cm. long, 2 cm. wide; petals [tepals] usually 2-2.5 cm. long, oblong-spatulate, with a very narrow claw.—Caucasus only. Flowers later than the type. Includes *G. nivalis*, vars. *G. Redoutei*, *major* and *caspius* of

Ruprecht." It should be noted that *G. nivalis* var. *Redoutei*, according to E. Ruprecht, often flowers 3 to 6 days before *G. nivalis*, the type; and that according to Baker (1887), subspecies *caucasicus* shows greatest affinity to *G. Imperiati* of southern Europe and *G. Elwesii* from Asia Minor.

Grossheim (1924, 1928) raised Baker's subspecies to specific rank—*Galanthus caucasicus* (Baker) Grossheim. It is obvious therefore that this species is on trial. If it cannot be demonstrated as a distinct species in nature, it will have to be reduced again to the rank of a subspecies. Plant explorers are urged to make every effort to furnish living and dried specimens of the plant in question so that its status can be cleared up.

7. *GALANTHUS MAXIMUS* Velenovsky, Fl. Bulg. 540. 1891.

DESCRIPTION.—Karyology, no reports. Sheath radical, membranous, horizontally truncate; leaves 2, slightly over 15-20 cm. long, 1.2-1.5 cm. wide, appearing with the flowers, broadly linear, scarcely narrowed at the base, slightly channeled (not plicate nor revolute at the margin), obtuse and shortly cucullate-attenuate at the apex; scape 15-20 cm. tall, almost equaling the leaves; flower pendulous; ovary 7 mm. wide and long; setepals 2.5 cm. x 13 mm., broadly obovate, decidedly concave (with the margins almost involute), rather more abruptly contracted at the base; petepals 12 mm. x 6 mm., half as long as the setepals, oblong, constricted for a short distance at the middle, obcordate, the entire interior surface green, on the exterior surface the lower part green and the upper part with 2 green spots, the lobes quadrate, obtuse, divergent (neither plicate-carinate within nor with the margin undulate-crisped); stamens half as long as the petepals; anthers yolk-yellow, 4-5 times as long as the filaments, rather broadly appendiculate at the apex.

RANGE.—Bulgaria: montane region at the City of Orhanie, and at Stiven.

NOTES.—Flowers at the beginning of spring.

Velenovsky observes that this is "The largest species in the genus, with its large flower exceeding the size of that in *Galanthus Elwesii* and *G. plicatus*.—From the former it differs among other characters, in the interior divisions [petepals] being neither undulate nor plicate-carinate nor evidently cuneate, from the latter in its leaves being neither plicate nor revolute on the margin. The basal sheath is abruptly horizontally truncate (in the form of a cup), not split on the side, as is the case in other *Galanthus* species.

Baker (Gard. Chron. 13 (1): 656. 1893) observes that "The Bulgarian *G. maximus*, of Velenowsky, is also nearly allied [as is Baker's *G. grandiflorus*] to *G. Elwesii*, and has a truncate basal sheath, leaves not reflexed at the margin, obovate, very concave outer perianth-segments, abruptly contracted at the base and the inner segments with a large green blotch on the lower part of the back and not crisped divergent quadrate apical lobes."

8. *GALANTHUS PERRYI* Baker, Gard. Chron. 13: 258. 1893.

DESCRIPTION.—Karyology: no reports. Bulb globose, 2.5 cm. in diam.; sheaths truncate, 3.8-5 cm. long; leaves at blooming time much shorter than the peduncle, about 5 cm. long, 1.3 cm. broad, slightly glaucous on both sides, nearly flat, edges not at all reflexed; peduncle

slender, 1.3-1.5 dm. tall; pedicel about as long as the inner spathe-valve; ovary green, globose, 3-4 mm. in diam.; setepals oblong, very convex on the back, 1.6-2 cm. long; petepals half as long, deeply emarginate at the apex, with a green horseshoe-shaped mark around the apical sinus, green inside, except at the edge, with distinct vertical white stripes; stamens much shorter than the petepals; anthers apiculate.

RANGE.—Caucasus.

NOTES.—Flowers in February. According to Baker (1893) this species is “intermediate between *G. latifolius* [cf. species no. 11. *G. platyphyllus*, below], and very nearly allied to *G. Alleni*. If *G. Alleni* is a hybrid between *latifolius* [= *G. platyphyllus*] and *caucasicus*, this is probably a hybrid also, the strain of *latifolius* [= *G. platyphyllus*] preponderating in *Aleni*, and of *caucasicus* in *Perryi*.”

9. *GALANTHUS ALLENI* Baker, Gard. Chron. 9: 298. 1891.

DESCRIPTION.—Karyology: no reports. Bulb globose, 1.3 cm. in diam., with a dense tuft of long slender root-fibres; leaf-sheath cylindrical, 5-7.6 cm. long; leaves 2, with a flat blade about 5 cm. long, 1.3 cm. broad, protruded from the sheath when the plant is in flower at the end of February; not bright green as in species no. 11, but dull green, and slightly glaucous; peduncle 1.5-1.8 dm. long; spathe linear, about 2.5 cm. long; ovary globose, green, trisulcate 4 mm. long and broad; setepals obovate, very convex, 2 cm. long, 1.3 cm. broad; petepals less than half as long as the setepals, emarginate, with a single horseshoe-shaped green blotch around the sinus; anthers 4 mm. long, sometimes muticous, sometimes distinctly apiculate; filaments very short; style overtopping the anthers.

RANGE.—Caucasus (according to the Index Kewensis).

NOTES.—The reader is referred to the notes under *G. Perryi*, above.

10. *GALANTHUS TRANSCAUCASICUS* Fomin, in Grossheim, Flora Caucasica 1: 244. 1928.

DESCRIPTION.—Karyology; no reports. Leaves dull green, simply channeled down the face, linear, with a blunt apex, up to 1.5 cm. wide; peduncle shorter than or equaling the leaves; setepals 2-2.5 cm. long, oval, somewhat elongated; petepals two-thirds as long as the setepals, spot semi-circular; anthers with a needle-like apiculus.

RANGE.—Transcaucasia.

NOTES.—The description is somewhat incomplete. It may be that the species was described more fully earlier, but no other reference could be found.

11. *Galanthus platyphyllus* Traub & Moldenke, **nom. nov.**

SYN.—*Galanthus latifolius* Ruprecht, Regel, Gartenfl. 17: 130, pl. 578, fig. 1, 1868, non Salisb. (1866); Baker, Gard. Chron. fig. 32c. 1879; 404, fig. 80. 1881; Baker, Amaryll. 17-18. 1888.

DESCRIPTION.—Karyology: no reports. Bulb 2.5 cm. in diam.; sheath short, truncate; leaves lorate, bright green, 2-2.5 cm. broad, simply channeled down the face; setepals oblong-spatulate, 1.3-2 cm. long; petepals with only a green patch round the sinus both inside and outside; anthers narrowed suddenly to an acute point.

RANGE.—Caucasus, alt. 1,829 to 2,743 meters.

NOTES.—Flowers in May.

When the fragment of Salisbury's *Genera Plantarum* was published in 1866, the binomial, *Galanthus latifolius* Salisb., based on Bot. Mag. pl. 2162, was included as a substitute name for *Galanthus plicatus* Bieb. Salisbury's name, although validly published, is a synonym of *G. plicatus* Bieb. Ruprecht (1868) apparently was unaware of this fact when he used the name, *Galanthus latifolius* Rupr. for a new species two years later. This name is therefore a later homonym and must be rejected. The new name, *Galanthus platyphyllus* Traub & Moldenke is proposed for Ruprecht's species.

12. *GALANTHUS FOSTERI* Baker, Gard. Chron. 5: 458. 1889.

DESCRIPTION.—Karyology: no reports. Leaves bright green, 1.5 dm. long at flowering time, 2-2.5 cm. broad, simply concave down the face; peduncle slender, faintly 2-edged, much shorter than the leaves; spathe-valve green, linear-lanceolate, 5 cm long; pedicel 3.8 cm. long, cernuous at the apex; ovary subglobose, 8 mm. in diam. at flowering time; setepals oblong spatulate, very convex on the back, rarely tipped with green, 2.5-3 cm. long, 1.3-2 cm. broad at the middle, narrowed to a claw, 6 mm. broad; petepals obovate-cuneate, not so closely connivent as in *G. Elwesii*, 1.3 cm. long, 8 mm. broad, with a shallow apical indentation, the two apical lobes semi-orbicular, erect, not at all spreading nor crisped, the apical sinus with a horseshoe-shaped green blotch under it, the lower half of petepal covered with another obovate-oblong green blotch; inner surface all green, with white vertical lines, except a narrow white border; stamens 6 mm. long, anthers with a distinct white apical spur above the yellow pollen-bearing portion; style just overtopping the anthers.

RANGE.—North-central Asia Minor; Province of Sirwas.

NOTES.—Flowers in late March. Baker (1889) observes, "So far as the flower goes, it looks most like the larger forms of *G. Elwesii*, but the leaves are broad and bright green, like those of *G. latifolius* [= *G. platyphyllus*], and the apical lobes of the inner perianth segments are short and erect, as they are said to be in *G. graecus* . . . In *G. Elwesii* the inner segments are narrowed suddenly just below the apical lobes, which are square and much larger than in *G. Fosteri*, spreading at the tip, and more or less crisped. In *G. Elwesii* the inner segments form a narrower tube than in any other species. Both *Elwesii* and *Fosteri* have a large green blotch on the lower part of the body of the inner segments. In *G. Fosteri* the stamens are not more than half as long as the inner segments, whilst in *nivalis*, *Elwesii* and *latifolius* [= *platyphyllus*] they are $\frac{3}{4}$ as long. The anthers of *Fosteri* have a distinct apiculus as in *nivalis* and *Elwesii*." Named for Prof. M. Foster, who imported the original bulbs into England.

13. *GALANTHUS CICILICUS* Baker, Gard. Chron. 21: 214. 1896.

DESCRIPTION.—Karyology: $2x=24$ (Heitz, 1926). Bulb ovoid, 1.3 cm. in diam.; outer tunics brown; basal sheath reaching a length of 7.6 cm.; leaves 2 or 3, bright green, flat, narrowly linear, reaching a length of 1.3-1.5 dm. at the flowering season, and a breadth of less than 3 cm., narrowed gradually from the middle to a very narrow base, edge not recurved, back whitish; peduncle as long as the leaves; spathe-valves lanceolate, under 2.5 cm. long; pedicel short, cernuous; ovary turbinate, 3-4 mm.

in diam.; setepals oblong, concave on the face, 2 cm. long, 6-8 mm. broad; petepals half as long as the setepals, obovate-cuneate, emarginate, somewhat reflexed and crenulate at the apex, with only the apical horseshoe-shaped green blotch round the sinus; anthers apiculate, reaching somewhat more than half-way up the petepals.

RANGE.—Asia Minor: Cicilian Taurus, alt. 560 m.

NOTES.—Flowers from November to March. Baker (1896) observes, "The absence or presence of a green blotch over the lower part of the back of the inner segments of the perianth is, I believe, a constant characteristic, and it divides the Spring Snowdrops into two groups, in one of which are *nivalis* and *cicilicus* and in the other *Elwesii* and *Fosteri*." He further states that *G. cicilicus* "Differs from *Fosteri* by its less robust habit, much narrower lobes, narrowed gradually from the middle to a very narrow base, and by the want of the large green blotch over the lower half of the back of the inner segments of the perianth which *Fosteri* has in common with *Elwesii*."

14. *GALANTHUS IKARIAE* Baker, Gard. Chron. 13; 506. 1893; Curtis' Bot. Mag. pl. 9474.

DESCRIPTION.—Karyology: no reports. Bulb unknown; sheath 5 cm. long, truncate at apex; leaves lorate, somewhat shorter than the scape, projecting 1-1.3 dm. from it at flowering time, bright glossy green. 1.3-2 cm. broad, the margin not at all recurved; scape 1.8-2 dm. tall; spathe linear, with reflexed edges, 3.8 cm. long; pedicel shorter than the spathe ovary oblong, 8 mm. long; setepals oblong-spatulate, nearly 2.5 cm. long; petepals cuneate, half as long, emarginate, with square apical lobes crisped at the edge, and with a tendency to recurve at the tip, the single apical green blotch occupying half of the outside of the petepals; anthers orange-yellow, minutely mucronate.

RANGE.—Isle of Nikaria, off the west coast of Asia Minor.

NOTES.—Flowers in April. Named for the Isle of Nikaria, the classical Icaria. Baker (1893) observes, "It has the bright green leaves of *G. Fosteri*, the quadrate lobes of the inner perianth segments with crisped edges of *G. Elwesii*, and the single apical blotch upon the inner segments of *G. nivalis*.—Mr. Allen compares the leaves to those of a *Leucojum*."

Subgenus 2. **PLICATANTHUS** Traub & Moldenke, **subg. nov.**

Folia supra late canaliculata, marginibus reduplicatis, glauca usque ad glaucissima vel flavo-viridia. Species typica: *Galanthus plicatus* Bieb.

DIAGNOSIS.—Leaves broadly channeled down the face, reduplicate at the edges; glaucous to very glaucous or yellowish-green in color.

TYPE SPECIES.—*Galanthus plicatus* Bieb.

15. *GALANTHUS ALPINUS* Sosnowsky, in Monit. Jard. Bot. Tiflis, 19: 26. 1911.

DESCRIPTION.—Karyology, no reports. Bulb large, ovate, exterior tunics dirty-colored; leaves broadly lanceolate-spathulate, the upper portion broad, gradually attenuate toward the base, rather acute, the young leaves cucullate at the apex, the adult ones almost flat, glaucous, keeled beneath, 2—plicate, cartilaginous in a very narrow margin, 8-9 cm. long, to 2 cm. wide, shorter than the scape during anthesis; scape 6-8 cm. tall;

spathe rather large, narrowly membranous at the margin and in the central part, transversed by two broad green striations; sepals broadly spatulate, shortly clawed at the base, rounded-cucullate and spoon-shaped at the apex, about 1.5 cm. long; petals about half as long, cuneate-cordate, retuse, green-spotted, the spots narrowly triangular, long-cordate and paler on the inner surface; anthers sagittate, a third as long as the petals; sepaline anthers attenuate at the base, petaline anthers submuticous; filaments short; flowers very fragrant.

RANGE.—Transcaucasus; Georgia: Mt. Lomis-mta near Borzhom, in the alpine region (7200 feet).

16. *GALANTHUS PLICATUS* Marschall von Bieberstein, *Flora taurico-caucasica*, 3 (suppl.): 255. 1819, non Guss., nec Hohen.; Bot. Mag. pl. 2162. 1820; Bot. Reg. 7: pl. 545. 1821; Herbert, *Amaryll.* 330. 1837; Baker, *Amaryll.* 18. 1888.

SYN.—*Galanthus nivalis* Falk, Beitr. 2: 156. 1786; *Galanthus latifolius* Salisb. Gen. Pl. Fragm. 95. 1866, non Ruprecht (1868).

DESCRIPTION.—Karyology: no reports. Bulb larger than in *G. nivalis*; leaves very glaucous, finally 3 dm. long, 2.5 cm. broad, broadly channeled down the face, and edges reduplicate; sepals oblong from a very narrow base, very convex on the back, 2-2.5 cm. long, widely spreading or even reflexed; petals deeply emarginate, green on the upper half, with a white edge; anthers lanceolate-acuminate, 7 mm. long.

RANGE.—Crimea and Dobruja; mts.

NOTES.—Baker (1888) states that the Caucasus plant often called *G. plicatus* is “*nivalis* subspecies *caucasicus*” [= *G. caucasicus* (Baker) Grossheim].

17. *GALANTHUS GRANDIFLORUS* Baker, Gard. Chron. 13(1); 656. 1893.

SYN.—*Galanthus maximus* Baker, Gard. Chron. 13(1): 354. 1893, non Velenowsky (1891).

DESCRIPTION.—Bulb globose, fully 2.5 cm. in diameter; sheath 10 cm. long, oblique or truncate at the throat; leaves reaching a length of 20-23 cm. above the sheath at flowering time, 1.3-2 cm. broad, slightly glaucous above, very glaucous below with a concave tip and distinctly recurved edges; peduncle as long as the leaves or a little longer, in all above 30 cm. tall; spathe 5 cm. long, linear, with very revolute edges; pedicel rather shorter than the spathe; ovary 6-8 mm. long; sepals oblong-spatulate, 2.5 cm. long, 8-12 mm. broad, convex on the back; petals obovate-cuneate, 1.3 cm. long, with round uncrisped erect apical lobes, and a large blotch of green round the sinus extending nearly half-way down; anthers apiculate, 6 mm. long.

RANGE.—Unknown (May be a hybrid.)

NOTES.—Flowers during the first half of March in England.

Baker described the plant under consideration as a new species or “hybrid?”, on the basis of material received from Mrs. Backhouse, of Sutton Court, near Hereford, England. Baker states, “If not a true species, it is, no doubt, as Mrs. Backhouse suggests, a hybrid between *G. plicatus* and one of the large varieties of *nivalis*, such as *Imperati*, *Melvillei* or *Redoutei*.”

Baker points out that this Snowdrop is notable for its relatively large bulb, and that it "is remarkable for its very robust habit, large leaves, spathe and flower, and long pedicel. The leaves have a distinctly recurved edge, as in *G. plicatus*, and are very glaucous beneath. The flowers resemble those of the large forms of *G. nivalis*. The anthers are distinctly mucronate, and there is present an apical green blotch on the back of the inner segments of the perianth, but this extends nearly half-way down."

18. *GALANTHUS WORONOWII* Losinsk., in Komarov, Fl. URSS. 4: 479, 749. 1935. (Type in the Herbarium, Inst. Bot. Russian Acad. Sci.)

DESCRIPTION.—Karyology, no reports. Bulb large, 3-4 cm. in diameter; leaves 15-20 cm. long, 1.5 cm. wide, yellowish-green, broadly linear, attenuate and callose at the apex, flat, longer than the scape after anthesis and introrsely plicate; scape 20-25 cm. tall, cylindric-costate; setepals 2 cm. long, 1.3 cm. wide, ovate, elliptic; petepals 11 mm. long, 8 mm. wide, flat, cuneate at the base, cordate at the apex, with green cordate spots; anthers mucronate; flowers odorous.

RANGE.—Mountains of Transcaucasus and central Caucasus.

NOTES.—According to the author of the species, "It differs from *G. caucasicus* (Baker) Grossh. in its plicate leaves, from *G. plicatus* Bieb. in its smaller flowers and its yellow-green and also introrsely plicate leaves."

19. *GALANTHUS BYZANTINUS* Baker, Gard. Chron. 13: 226. 1893.

DESCRIPTION.—Karyology: no reports. Bulb middle-sized, globose; leaves at flowering time shorter than the scape, 7.6 cm. broad, glaucous on both sides, especially beneath, broadly channeled down the face, the margins, as in the Crimean Snowdrop, *G. plicatus*, distinctly and permanently recurved; scape slender, 1.5 dm. tall; spathe linear, deeply channeled down the face; pedicel as long as or shorter than the spathe; ovary obovate, hardly at all glaucous; setepals oblong, convex on the back, 2 cm. long, 8 mm. broad; petepals half as long as setepals, obovate-cuneate, deeply emarginate with a green horseshoe-shaped mark round the sinus, the edge of the lobes somewhat reflexed, and crisped, and another green blotch covering the lower part of their back; stamens much shorter than the petepals; anthers orange, very apiculate.

RANGE.—Southeastern Europe, (Eur. or.), according to the Index Kewensis.

NOTES.—Flowers in February. According to Baker (1893) this species is "Intermediate between *G. plicatus* and *G. Elwesii*. It has glaucous leaves broadly channeled down the face, with distinctly reflexed edges, as in the former and inner perianth segments marked with green, not only at the top, but also on the lower part of the back, as in the latter."

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ADDENDA

Erinosma vernum Herb., Amaryll. 331. 1837=*Leucojum vernum* Linn.
Galanthus vernus Alloni, Fl. Pedem. 2: 155. 1785=*Leucojum vernum* Linn.
Lapiedra gracilis Baker, Jour. Linn. Soc. 16: 678. 1878=*Tapienanthus humilis*
Leucojum aestivale Steud., in Steud. Nom. ed. 2. 2: 196. 1841=*Leucojum aestivum*
Linn.
Leucojum grandiflorum Vent., in Salisb., Gen. Pl. Fragm. 96. 1866=*Leucojum autum-*
nale Linn.

According to "A. O." (Gard. Chron. CXXII: 185, fig. 90, 1947), *Galanthus caucasicus* (Baker) Grossh., has broader and longer leaves, 2 to 2.3 dm. long, and 2 cm. broad, and larger flowers produced a little later than those of *G. nivalis* Linn. On the basis indicated by "A. O." *G. caucasicus* might be maintained as a species for it would be sexually isolated from *G. nivalis* due to a later flowering season.

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AMARYLLID GENERA AND SPECIES

[In this department the descriptions of amaryllid genera and species, particularly recent ones, translated from foreign languages, will be published from time to time so that these will be available to American and British readers.—*Harold N. Moldenke*]

Genus HANNONIA Braun-Blanquet et Marie

Bull. Soc. d'Hist. Nat. l'Afr. Nord, 22: 104-105. 1931.

Allied to the genus *Cyrtanthus*, but differing from it in having a straight, erect perigone, (lacking the long tepaltube with dilated throat), with the tepalsegs much longer than the tepaltube, and with the three nerves of the tepalsegs forming a green band due to their nearness to each other. From *Sternbergia*, to which it is also related, it differs in its white, 2-flowered umbel. [Monotypic.]

1. HANNONIA HESPERIDUM Braun-Blanquet et Marie, l. c.

Description.—Plant entirely smooth. Rootstock a single bulb, subglobose, ovid, 20-25 x 20 mm., with a long neck, up to 4 cm. long; bulb and neck covered with a black membranous coat; outermost leaf reduced to a scarious sheath, provided with a very short blade; inner leaves 2 or 3, linear, *flat, glaucous*, rather fleshy, about 2 mm. broad, up to 22 cm. long, the apex conspicuously obtuse; scape 10-12 cm. long, *terete*, hollow, glaucous; spathe 2-valved, the valves scarious, whitish, lanceolate, rather acutish, appressed to the perigone for about half their length; umbel 2-flowered, pedicels short; flowers about 18 mm. long; tepaltube white, short, scarcely 5 mm. long; tepalsegs linear-lanceolate, broadened below the apex, gradually and evenly attenuate toward the base, the apex subcucullate, acute, mucronate (the mucro green and barbulate), white within, white outside but *marked with a single band formed by the three green nerves that are very close together*, subequal, about 11 x 2 mm.; paraperigone absent; filament *terete*, white, 3 stamens equaling the tepalsegs, 3 shorter; anthers yellow, attached at the middle, oblong, the apex rounded-truncate, the base shortly emarginate; style *white*, *terete*, equaling the stamens; stigma scarcely thickened, obscurely 3-lobed; ovary about 2 mm. long, green, 3-celled; 5 or 6 ovules in each cell.

Range.—Morocco; grows in rock-fissures at the Atlantic Ocean shore near the Promontory of Hercules (Gap Ghir), at an altitude of 50-100 meters.

Notes.—Sparingly in flower in March and April when the type material was collected. Type specimens have been deposited in the herbarium of the University of Algiers, and in the Braun-Blanquet herbarium.

Genus ALLIUM Linn.

ALLIUM PAUCIFLORUM Larranaga, Escritos D. A. Larranaga (publ. Inst. Hist. Geog. Uruguay) 2: 135. 1923.

“Scape leafless, terete, subequaling the linear leaves; umbel laxly few-flowered (about 7-flowered); stamens subulate, oval at the base. May 26, 1809.”

ALLIUM BIFLORUM Larranaga, l. c.

“Scape leafless, terete; leaves and stamens subulate. September, 1810.”

ALLIUM TRIFLORUM Larranaga, l. c.

“Scape leafless, terete, umbel 3-flowered; leaves linear; stamens subulate, half as long as the perigone. May 8, 1814.”

ALLIUM UNIFLORUM Larranaga, l. c.

“Umbel 1-flowered; perigone tubular. June 22, 1809.”

“Note [by Larranaga].—These four species are widely separated from the rest of the genus [*Allium*], and possibly may be grouped together to form a new genus, which could possibly include also *A. gracile* of Jamaica, and other American species of *Allium*. Apparently this genus [*Allium*] is very rare on this continent. The description of these species should shed more light on these conjectures.”

[AMARYLLIDS NORTHWEST—Continued from page 171.]

With the shortening of the hours of labor an ever increasing number of gardeners are putting up small greenhouses in which they can defy the vicissitudes of weather and grow many of these more tender and exotic plants and lengthen and augment the season of colorful bloom. May their tribe continue to increase.

AMARYLLID REGISTRATION SERVICE TERMINOLOGY

The meanings of the terms—origination, originator; registration, registrant; introduction, introducer; and distribution, distributor—as used in connection with the AMARYLLID REGISTRATION SERVICE have not been published in *HERBERTIA* up to the present. To make good this deficiency, the following definitions are presented. The terms as used in connection with the registration of *Hemerocallis* clones (classed with the amaryllids) will be reconsidered in 1948 by the JOINT COMMITTEE ON HEMEROCALLIS REGISTRATION sponsored jointly by the AMERICAN PLANT LIFE SOCIETY and the MIDWEST HEMEROCALLIS SOCIETY.

It should be noted that the originator may assume also the roles of registrant, introducer and distributor; or that the latter three roles could be assumed by one or more other persons or organizations.

The well-known definition that a clone consists of all of its ramets is recognized.

ORIGINATION; ORIGINATOR.—The term, originator, refers to the person or organization actually concerned in the plant breeding procedure that gives rise to the clone or clones. Anyone obtaining a clone or clones from another, or selecting clones for introduction from progeny produced by another, is obviously under moral obligation to acknowledge this fact when introducing any such clone or clones, no matter whether such clone or clones, or the progeny from which the clone is selected, have been acquired as a gift or for a consideration.

REGISTRATION; REGISTRANT; REGISTRAR.—The term, registration, refers to an arrangement whereby the names and descriptions of bona fide clones are recorded by the registrar by date (and number if desired) for the registration agency either before or after publication of the names with descriptions of the clones. Normally the registration should take place before publication. The normal procedure is as follows: the registrant, the person or organization registering the clone, sends in to the registrar the description with proposed name, or the proposed name only (for which there must be a bona fide clone in existence) in order to find out if the name is already in use. If it is not already in use according to available records, it will be registered, but if the name is already in use then an unused name must be substituted. In cases where only the proposed name is first sent in, the description must also be submitted as soon as practicable in order to complete the registration. Names only are not subject to registration. These rules obviously apply only to the organization and persons concerned for it is out of the question for one organization to presume to legislate for the whole world. However, in actual practice the registration service practically eliminates duplicated names for those concerned with the advancement of a particular plant group, who introduce clones, *sooner or later*, avail themselves of that service and thus keep in actual touch with one another through the registrar.

To obtain priority for the name under the INTERNATIONAL RULES OF BOTANICAL NOMENCLATURE, which *include also cultivated plants as a branch of botany; first publication of the name with a description that*

covers the clone is required. All *later uses* of the same name in any particular plant group are referred to as *later homonyms, and are invalid names under the International Rules*. Publication of amaryllid names may be in HERBERTIA or elsewhere, either before or after registration, but preferably the former. Publication should be in *dated* publications, including *dated* trade lists and catalogs.

INTRODUCTION ; INTRODUCER.—The term, introducer, has been used in this connection in the general sense on the basis of the definition in Webster's Dictionary—"to bring into knowledge or understanding of something." The introducer is therefore the person or organization bringing the name with description to public knowledge. It is assumed that the registrant-introducer is acting in good faith, and actually has a distinct new clone for each name with description submitted, and that that clone will be distributed in a reasonable time, except for a valid reason, or that at least that the original seedling or mutation with or without ramets is growing under test where those interested could view it under supervision of the owner. It has been suggested that the term, describer, would be a better one to use in place of the term, introducer, but that is a matter for future consideration.

DISTRIBUTION ; DISTRIBUTOR.—The term, distributor, refers to the one who actually first transfers ramets of a clone to others either free of charge or by sale.

—HAMILTON P. TRAUB

COLOR CLASSIFICATION FOR DAYLILIES

M. FREDERICK STUNTZ

So many have asked for an explanation about the manner of indicating the general color values of daylilies in the forthcoming Check List of Daylilies that the following brief description of the system to be followed is given.

First of all, we desire to make it clear that nothing in this article is intended to impose any difficulty upon those sending us new names for registration. The introducer (or originator) is privileged to define the colors in any way that seems most fitting in his own words. The registrar will then translate this description to conform to the standard method of color classification used. This is in essence, the same as that which has been used with signal success by the American Iris Society for many years.

This method is easily applied to daylilies for the number of segments (tepalsegs in daylilies) in each is the same. In daylilies the predominant color is usually found in the petals (petepalsegs in daylilies), whereas in irises it is the standards; and the subordinate color is usually in the sepals (setepalsegs in daylilies), according to the falls in irises.

The color symbols are intended to convey only a general idea of the colors in each flower. The system is comprehensive enough so that it could be applied to any flower; and, while as yet we have no white nor blue daylilies, provision is made for them, when they are attained.

In order to make the color classification as simple as possible only the generic color names are used and are abbreviated as follows :

The letter R will stand for red, B for blue, Y for yellow, W for white, and S for shot, blends, or polychromes. One of these letters will be used to designate the predominant color effect of the flowers of every clone.

In addition to the primary color abbreviations, R, B, Y, etc., the secondary or modifying color will be designated by the numbers 1 to 9. These numbers, three for each color; i. e., 1, 2, 3, for blue; 4, 5, 6 for yellow; 7, 8, 9 for red; will also determine whether it is a self,—1, 4, 7 practically the same color in both petals (Petepalsegs) and sepals (setepalsegs); mottled, margined, or veined,—2, 5, 8; or a bicolor [petals (Petepalsegs) a different color than the sepals (setepalsegs)],—3, 6, 9. This is readily visualized in the following table:

	Blue toned	Yellow toned	Pink or Red toned
Selfs or near selfs	1	4	7
Margined, mottled or veined	2	5	8
Bicolors	3	6	9

After the letter and number will follow the letters for light, L; for medium tone, M; for Dark, D. If the sepals (setepalsegs) are darker than the petals (Petepalsegs), the abbreviation “rev.” (=revolute or reverse) will be added.

The few examples following are not arbitrary, and are merely cited by the writer, who has had only limited experience in observing the color of daylilies, as a beginning toward a better selection in each color range later; and he would appreciate any suggestions.

R1 represents a red self with enough blue to make it a red-purple; and perhaps the best example at this time is *Potentate* (=RID), or *Black Falcon* (=RID). There is no blue-purple daylily, but should we ever get one, it would be designated as B7.

R2 is a red with the subordinate color blue in some variation such as feathered edges, splashes or veins, as in *Cherokee Maid* (=R2D), or *Amherst* (=R2D).

R3 is a red bicolor or bi-tone such as *Persian Princess* (=R3D). This may not be a good example for there are few daylilies with enough blue in the color to come under this classification.

R4 is a red self with yellow infusion such as *Dawn* (=R4L), *Baronet* (=R4M), *Brackel* (=R4D), *Cissie Guisseppi* (=R4D). Clones like *Imperator* (=R4D) and *Iris Perry* (=R5M) could also be classified as Y8, but since the general impression is red-orange, they are placed in this category. Another good example is *Indian Chief* (=R4M).

R5 is a red with yellow toned edges, veins or markings like *Honey Redhead* (=R5D); or *June Boissier* (=R5L).

R6 is a red and yellow bi-color or bi-tone such as *Woodridge* (=R6M); or *Zouave* (=R6D). *Bicolor* (=R6M) and *Caballero* (=R6M) come very close to being Y9M and could just as appropriately be placed in that color class.

R7 is a pure red self, or as near as we have come to it in daylilies, such as *Royal Ruby* (=R7M), *Ruby Supreme* (=R7M), *Berwyn* (=R7M), *Port* (=R7M), *Theron* (=R7D), *Vulcan* (=R7D). While *Hemerocallis fulva rosea* and *Rosalind* (=R7M) are placed in this class, they could also be classed as two-tone reds (pink) R9L.

R8 is a red self with markings in a different tone of red. *Kanapaha* (=R8M) with its lighter toned edges would come in this class; *Orlando* (=R8M), *Redahd* (=R8), also belong here.

R9 is a red bi-color, or with sepals (setepalsegs) such as *La Tulipe* (=R9D); *Rajah* (=R9M); *Pascagoula* (=R9D); *Dominion* (=R9M).

Time forbids going into detailed examples of the other color classes. *Mongol* (Y4D), while not as dark a yellow as *Golden West* (Y4D), is darker than most in the medium yellow class. *Orange Beauty* (Y4D) one of the richest of all yellow daylilies, is not orange but predominantly yellow. *Dr. Stout* (Y8M) is a decided yellow orange and could be classed as Y7M but on account of the Brazil flecking is placed in Y8M. The same applies to *Halo Wheeler* (Y8M) and *Halo Yeld* (Y8M), both predominantly yellow, but on account of the large halo are given the subordinate number 8. While *D. D. Wyman* (Y7M) has a noticeable tawny splash on the petals (petepalsegs) it is hardly sufficient to classify it as Y9M, and therefore it is placed in Y7M.

Spotted varieties, like *Mikado* (S7M), are indicated by placing them in the shot or blend class.

Cinnabar (S7M) is a decided blend with the red tone predominating.

All of this will be fully explained in greater detail at the beginning of the Check List. We are hoping to receive during the coming winter all outstanding lists, especially the missing ones from some of the largest introducers, so that the Check List can be finally completed. Thus with the kind assistance of the members of the *hemerocallis* clan, we believe that a good beginning can be made toward a complete listing and description of daylilies.

REGISTRATION OF NEW AMARYLLID CLONES

Descriptions of new clones of hybrid amaryllids for this section should reach the editor by September 1 if at all possible. Information sent after that date may be held over to the next issue if space is not available. This information is published to avoid duplication of names, and to provide a place for authentic recording of *brief* descriptions. Names should be as short as possible—*one word is sufficient*. It is suggested that in no case should more than two words be used.

At present there is a limit to the number of descriptions included from any one member. Not more than five brief descriptions of clones under each generic heading will be published free of charge from any one member in any issue of *HERBERTIA*. Additional descriptions will be published in the advertising section at regular ad rates. The first five descriptions will appear in this section and the excess will be continued in the section entitled, "Buyers' Guide."

HYBRID DAYLILY (HEMEROCALLIS) CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.*; (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.*; (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.*; (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.*; (5) *Texas A. & M. College, Dept. of Horticulture, College Station, Texas*; and (6) *Des Moines Park Board, Des Moines, Iowa*. [Complete addresses are given under *Officers and Committees*, below.]

Introducers should send complete collection of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced By Stanley E. Saxton, Faust, New York.

Pinocchio. Medium small flower with wide, overlapping segments somewhat recurved on ends. Petals $1\frac{1}{4}$ ", peach pink with eye zone of light garnet. Sepals a shade lighter. Plant small with narrow leaves. Scapes wiry, 36", erect, 15 to 20 buds. (*Serenade X Mikado*)

Myrna. Medium large flower with wide segments recurved at the tips. A rosy purple self, near magenta. About 25 buds to the scape which stands 30" high, somewhat arching. Strong growing plant, very hardy, increases rapidly and makes a showy garden subject. (*B. H. Farr X Theron*)

Rosash. Large flower with wide segments, crinkled and somewhat twisted. Irregular trumpet shape. Color is Attar of Roses (M&P 4H10). Robust plant with strong scapes about 38" tall.

Saratoga. Very large flower up to $6\frac{1}{2}$ ". Petals $1\frac{3}{4}$ " wide, slightly recurved, rusty red. Sepals over 1" wide, recurved, buff yellow with embossed edges. This flower was selected for its beautiful form, large size and sturdy stalk. The plant is a strong grower and the flower lasts well into the evening. Scape 38" tall.

Taffy. A large pastel in tones of light yellow, buff and peach pink. The wide segments have a silky texture, the colors so blended that an iridescent effect is produced. The flower is very open with segments much recurved. Strong plant. Stalks somewhat arching and about 36" tall. (*B. H. Farr* X *Blondie*)

Introduced by John V. Watkins, University of Florida, Gainesville, Fla.

Tamiami—Plant very robust in northern Florida, multiplying rapidly to form large clumps. Foliage upright, sharp-pointed, to about 18 inches, strongly evergreen, attractive the year around.

The scapes are slender, somewhat declinate and form no proliferations.

The flower is large (14.5 cm.), spreading, giving a bold day-long garden effect as it does not roll or fade badly in the April sun. Color outside, Mirabelle, 10-J-7 (Marez & Paul, A Dictionary of Color) color throat, near yellow ochre 11-L-7.

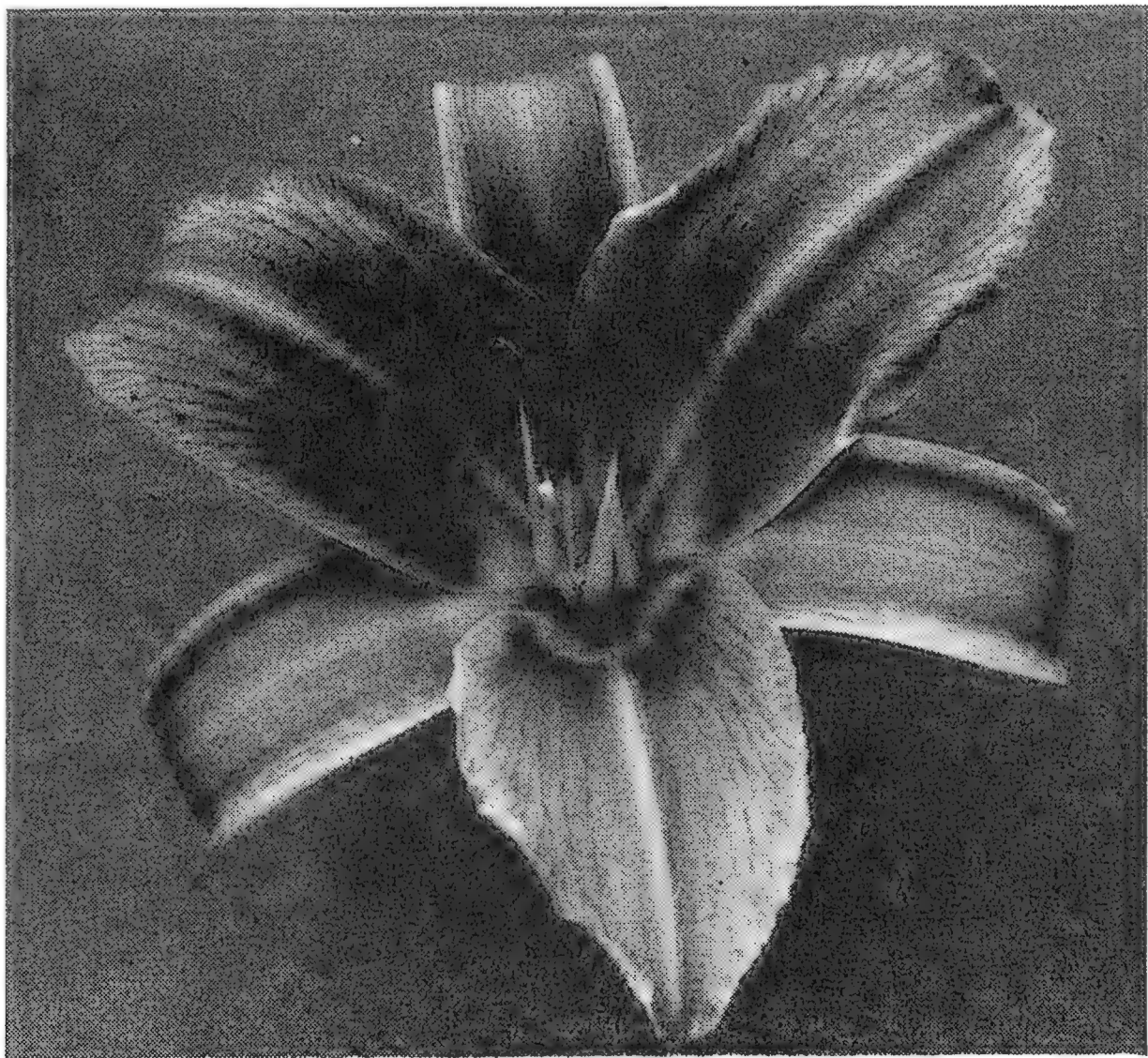


Fig. 180. Hybrid Daylily—**Tamiami**.
Photo by John V. Watkins.

The sepal (10 cm. x 2.5 cm.) is self-colored, Pompeian red 4-J-10*, and there is no differentiation of margin or mid-rib. The sepal is slightly recurved. The petal (10.5 cm. x 4 cm.) is self-colored Pompeian red 4-J-10, with the veining but slightly darker. The petal is very slightly recurved if at all.

This seedling, resulting from five generations of selective breeding, flowered first on April 10, 1943 and was chosen for naming and propa-

gation on April 20, 1945. None of the available commercial clones exhibit the outstanding soft pink garden tone that is the salient feature of this selection. *Tamiami* is in propagation and will be introduced to Florida gardeners in 1950.

Introduced by M. B. Matlack, Arlington, Va.

Midnight Sun. Scapes $3\frac{1}{2}$ to 4 feet high with a good branching habit and 16 to 22 six inch buds; flower $5\frac{1}{2}$ to $6\frac{1}{2}$ inches wide, pure orange with almost no green color in the throat, graceful long petals $1\frac{1}{2}$ inches wide, sepals $\frac{7}{8}$ inch wide, the surface smooth with a good pleasing finish, petal margins slightly waved or ruffled, texture good; opening after sunrise and remaining open until midnight on cool nights.

Introduced by W. R. Ballard, Hyattsville, Md.

Color Contrast. Scape 2 feet high; flower width 4 inches, sepals sun-flower, flushing petal color on edge, recurved, petals 1 inch wide, pinched in at end, chrysanthemum; day blooming in August.

Dainty Pastel. Scape 2 feet high; flower $2\frac{1}{2}$ inches wide, segments strongly recurved, sepals empire yellow, petals over 1 inch wide, salmon merging into sepal color at midrib, margin frilled on one side; day blooming in August.

Introduced by J. B. S. Norton, Hyattsville, Md.

California. Scape 2 feet high, widely short branched; flowers wide bell shaped, 4 inches wide, cadmium self, substance excellent, petals 1 inch wide, sepals $\frac{1}{4}$ inch; day blooming, beginning to bloom Aug. 10, extending into September.

Introduced by Chas. E. F. Gersdorff, 1825 North Capitol St., Washington, D. C.

Bomb Burst. 30", $4\frac{1}{2}$ ", 22 hours, heavy substance, sepals orange chrome thinly edged morocco red, petals with crimped edges, orange chrome stippled lightly with morocco red to a halo at beginning of orange chrome throat, reverses the same, tips frequently pinched and thickened, yellow to green, opening late June (*Calypso* x *Cressida*).

Bronze Nymph. 34" ; 4", 16 hours, medium heavy substance, petals wavy with ridged mid-bands, sepals twisted wavy, bronzy deep chrome overflushed English red, heavier on sepals than petals, reverses deep chrome flushed English red, opens late June (*Cressida* x *Hyperion*).

Lively Dawn. 40", $6\frac{1}{2}$ ", 15 hours, heavy substance, lily form, tips of sepals twist and reflex, edges of petals ruffled, self of deep orange chrome, opens mid-June (*Golden Dream* x *Calypso*).

Marion Williams. (inform. intro. 1946), 30", $6\frac{1}{2}$ ", 14 hours, medium heavy substance, narrow segments, star form, petals mars orange, mid-bands orange yellow, sepals deep chrome flushed on edges with mars orange, opens late June (*Alamo* x *Dawn*).

Nimbus. 36", 5", 21 hours, medium heavy substance, *petal* edges undulate, *pale apricot buff*, edges delicately flushed orange rufous, *sepals* more heavily flushed orange rufous, halo of pompeian red, color in half shade, while in sun is a pale apricot buff with pale halo of pompeian red, and if cool and wet is dusted with pink; opens mid-June (*Cressida* x *Calypso*).

Introduced by L. Ernest Plouf, Lawrence, Mass.

Stratford Panel. 4 ft. July-Aug. Rich gold 6" stellate flower; firm, very open distinct form; slightly pinched inner segments flare and twist giving grace; in contrast, outer segments smooth with neatly embossed edges; speckled tan area; heavy chamois substance; round outline; floriferous; slender erect stems; keeps well late.

Tagalong. 3½ ft. Aug.-Sept. Late and long blooming season; fine chamois substance; small rich soft orange flower gold-glistening; gold throat; slight fulvous area on inner segments; good erect stem.

Towntie. 3 ft. July-Aug. Pure lemon miniature; 2½" trumpet; firm substance; good form and keeping quality; slender erect wiry stem.

African Mosque. 3 ft. Aug. Deep burnt yellow 5" flaring flower; throat olive-cast, wide and effective; inner segments full and nicely crinkled; large, wide open, full and Amaryllis-like; excellent substance; keeps until dark. Features: form, firmness of substance, color and size.

Algerian Sortie. 4 ft. July-Aug. Inner segments pink-rose with broad cream midrib; very full and crinkled; outer segments cream flushed rose; canary throat; no fulvous tones; decidedly and roundly recurved; good stem; robust; good habit. A large well formed firm flower. Classified among the pinks.

Introduced by Mrs. J. F. Emigholz, Cincinnati, Ohio.

Queen Titania. Height 48 inches, flowering in July; flower 4 inches across, maize yellow, faintly flushed old rose, with a faint banding of same, pale buff yellow edge and midrib; by color chart: pale ochraceous buff, veined and flushed carrot red, darker banding. Dainty colored and very free flowering.

Etna. (*Bold Warrior* x *Temple Fire*). Height 38 inches; flower 5¼ inches wide, petals 1¼, slightly recurving, Brazil red, overcast velvety Morocco red, faint yellow midrib, greenish throat; July bloom. A dark velvety carmine red, unfading, with an iridescent sheen.

Cornelia (*Mrs. Crawford* x *Milady*). Height 42 inches; flowers in July, 5 inches across, petals 1⅝ wide, light eugenia red, edge buff yellow, throat veined carrot red on green yellow; all segments wavy and slightly reflexed. A charming rosy tone that fades to a softer coloring.

Eugenia. Height 42 inches; flowers in July and August, 5 inches across, closed lily-like form, all segments fluted and slightly recurved,

Eugenia red with raised creamy midrib, throat deep chrome, petals $1\frac{1}{4}$ inches wide. An unfading rosy red.

Mariposa. Height 42 inches; flowers in July, $4\frac{1}{2}$ inches across, light cadmium yellow, a heavy banding of purplish madder brown on the petals, sepals with a slight zoning, petals deeply reflexed. A very distinct form; looks like a Mariposa lily.

Introduced by Ralph W. Wheeler, Winter Park, Florida.

Scarlet Sunset. This is the most vivid red of any daylily which has bloomed for me, definitely a true scarlet and with the penetrating quality of fire. The throat is orange as also are the lines of the petal midribs. The flower is only medium large but opens widely and has a distinction of form. The petals are frilled and slightly recurved or twisted at the tips. Its stems are up to three feet and somewhat branched. A mid season bloomer in Florida.

William Penn. This huge flower, carried on 40 inch stems, is a garden show piece. It is widely open, forming a large, shallow throat and its beautifully frilled and creped segments are recurved only slightly. In coloring it is reddish chocolate in varying shades, all over suffused with intense violet tones which produces an iridescent effect. Measured by the Standard Color Card the colors run from the lighter Attar of Roses through Rose Ash, to Raisin and the much deeper Catawba in the eye zone section, but with considerably more violet than in any of these. Relieving this otherwise very dark flower is a throat of brightest canary yellow. The flowering stems on occasion have proliferations. It blooms late in the season in Florida.

Brandywine. A large flower of rich, deep mahogany coloring, shading to a purple eye zone. The throat is bright orange and extends in wide bands into the petals, gradually narrowing into lines. The orange coloring shows through the midrib section of the sepals. The flower is compact, full, very wide segments, the sepals being quite recurved while the petals open flat with the tips sometimes twisted or recurved. Stems 30".

Demi-Tasse. This is a semi dwarf bicolor in magenta and orange. The flower is small with a deep throat, thus making it appear even smaller than it really is. The stems are 16" and have produced up to 34 flowers to a stem.

Madam Butterfly. An eye spot flower of striking color combination. The flower color is light orange, wide eye spots surrounding the throat being a rusty reddish light chocolate. The flower is large, segments wide, well open, recurved and twisted at the tips. The petals are creped and frilled. Stems are 36".

EDITORIAL NOTE.—The *Hemerocallis* clones, *Ming Toy*, *Olympus*, *Psyche* and *Vega*, introduced by Mr. Wheeler in 1947, will be described in 1948 HERBERTIA.

Introduced by Mrs. Bright Taylor, Ocala, Florida.

Suez, Height 3½'. Evergreen foliage. Flower, standing 4½", quite recurved, two-toned purple red, off turtle dove (Pl. 55 L 1) veined darker. Throat, sulphur yellow (Pl. 10 J 1) shading to primuline yellow (Pl. 10 L 5) star shaped. Effective garden plant, better in semi-shade. Petals 3⅞" x 1⅜"; sepals 3¾" x ⅞".

Shalimar, Height 40". Evergreen foliage. Flower standing, 5". Two-toned centric between salmon and saffron (Pl. 10 C 8). Petals wavy with faint veining, giving darker effect; sepals slightly recurved. Throat jonquil (Pl. 9 J 5). Well branched and floriferous.

Lochinvar, Height 30". Evergreen foliage. Large, widely opened flower with broad shallow throat. Petals, ember red (Pl. 5 K 10) faint eye zone 3½" x 1½"; sepals same, 3½" x 1". Throat very wide cadmium yellow (Pl. 9 L 8). Early bloomer, with long flowering season.

Garden Flame, Height 3'. Evergreen foliage. Large flower. Petals 4" x 1¾", totem red (Pl. 4 J 12). Sepals 4½" x 1", slightly lighter. Throat near sunkist (Pl. 9 L 9).

Sweet Alice, Height 34". Foliage semi-dormant. Flower ember glow (Pl. 3 G 10). Diameter of flower standing, 4¼". Throat golden yellow (Pl. 10 L 7) petals 3¾" x 1¼". Sepals 3¾" x ⅞". Faint mid rib. Flowers just top foliage mass, are very floriferous and in the garden give a rosy effect.

NOTE: Color references are to Paul and Maerz' "A Dictionary of Color".

HYBRID AMARYLLIS CLONES

Introduced by Mr. Garnald D. Zeiner, Lost Springs, Kansas.

Freckles; Leopoldii type B; white with pink spots and stripes.

Gold Dust; Leopoldii type A; orange red, flower 8½" in diameter.

Jack Frost; Reginae type B; white with pink stripes and frostings.

Lightning; Reginae type B; white with pink stripes which run lengthwise of tepalsegs to near the end.

3. GENETICS AND BREEDING

FASCINATING DAYLILIES—THE BEGINNING OF A HOBBY

J. MARION SHULL, *Maryland*

When I made my first *Hemerocallis* cross in 1927 I had little idea how fascinating the game would become in later years. I had been working with Iris for more than a decade and because of their extreme range of color variation, apparently rivaled only by that of the pansy, was not surprised at the ever increasing modulations of color in succeeding generations.

But in *Hemerocallis* there did not seem such a wealth of variability to work with. There were the light lemon of *Hemerocallis flava*, the "Lemon Lily" of old gardens; the richer plain yellow of *H. middendorfi*; the tawny but variable color of *H. fulva* with its well-defined eye-zone of a deeper color, and *H. Dumortierii* with the questionably desirable darker color on back faces of segments that tended to dull the color effect in the garden. There were other varieties to be had but mostly they were within this same color range. There were no reds.

To a breeder working with Iris this did not seem a very promising lot of colors to work with, but I did apply some pollen of *H. fulva* to stigmas of *H. serotina*, then more commonly known by the usual catalog name of *H. Thunbergii*, the name under which I had received it from my Mother's Ohio garden.

Since *H. fulva* reputedly would not set seed I did not make any attempt to breed the two varieties in reverse but with pollen of *Fulva* on stigmas of *Thunbergii* I got a small batch of seed, just 9 to be exact, and from these nine only three eventually "hatched" and came into bloom, two of them so identically like the mother *Thunbergii* that I could not distinguish them in any way from each other or from the seed parent, but the remaining plant was so utterly unlike either parent that I became greatly interested in it and its future possibilities. It had broader petals than either parent, was more regular than *Fulva*, with slight ruffling at petal margins. The body color was rich yellow tending toward orange, and instead of the sharply-defined eye of the male parent, there was an overlay of flecked red gradually intensifying to nearly solid color as it approached the lighter cadmium yellow of the throat. Over-all effect of the flower at a little distance was a bright orange.

Having kept rather closely in touch with the work of my brother, Dr. George H. Shull, of the Carnegie Institution's Station for Experimental Evolution at Cold Spring Harbor, where he had recently discovered and demonstrated the value of controlled hybridity in field corn, a discovery destined to completely revolutionize the growing of corn throughout the country, it was only natural that I should look to this obviously hybrid *Hemerocallis* for interesting results in future generations.

Like its male parent, *H. fulva*, it would not set seed to its own pollen, further demonstrating its general hybrid character. Even with other pollens it was very reluctant to set seed. Ovaries would respond to pollination and begin to grow, then after doubling or tripling in size become a dark but unnatural green shortly to move toward yellow and then drop off. About one pollination in twenty would escape this fate and produce seed, but very sparingly.



Fig. 181. (Upper left) "Thulva" [*H. serotina* (*Thunbergii*) x *H. fulva* (*Europa*)]. Shull, 1927. (Upper right) "Mahog", "Thulva" x *Florham*. Shull, 1933. (Lower left) "Mahog Sister", also "Thulva" x *Florham*, Shull 1933. (Lower right) F-2 (Shull), "Mahog" x *Hyperion*, Shull, 1938. All drawn by J. Marion Shull.

Bred to the variety *Florham*, a yellow self of somewhat clouded ancestry, the resulting seed gave two sisters, both bicolors in varying degree although no definitely bicolor character is to be found in either immediate parent or in either of the grandparents. One had petals of solid Mahogany Red with light yellow center stripe, and sepal segments of Sienna Yellow; the other was many degrees lighter but equally bicolor, petals yellow with nearly solid reddish overlay, sepals bright,

nearly clear yellow. Both flowers had ruffle edged petals and only a suggestion of an eye, not clearly defined.

These in turn entered into the breeding material of succeeding years. For convenience of recording, the first hybrid became known as "Thulva" (Fig. 181) a mixed name combining both parental sources; members of the next generation were dubbed "Mahog" (Fig. 181) short gardenese for Mahogany Red, and "Mahog Sister" (Fig. 181) respectively.

"Mahog" was then mated with *Hyperion*. Again the resulting family was quite small, only four sisters coming to maturity. These grew in row F and were therefore designated as F-1, F-2, F-3 and F-4 in series for garden record convenience. F-2 was a yellow self despite its bicolor "Mahog" mother. F-1 (Fig. 181) was very slightly bicolor in character, the petals lightly flashed with russet and with a delicate

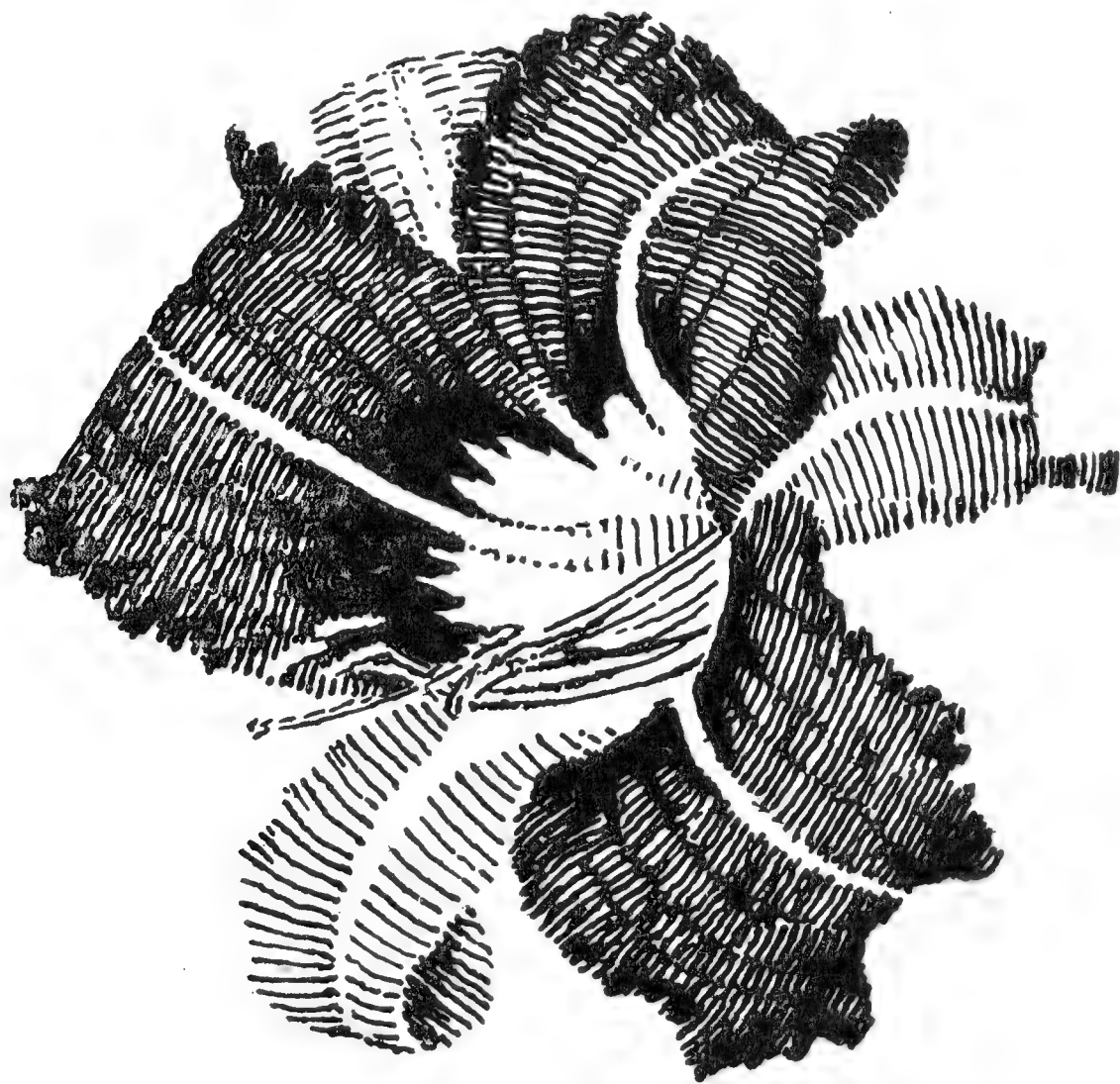


Fig 182. Hybrid Dayily—F-3 Shull, a ruffled bicolor, "Mahog" X *Hyperion*. Shull 1938. Drawing by J. Marion Shull.

but well-defined new-moon crescent in the eye-zone. F-4 was practically a self but lightly tinged with russet throughout. F-3 (Fig. 182) on the other hand was strongly bicolor, an intensification of its mother with strong Mahogany Red petals that were wider and more ruffled than in "Mahog." Sepals brighter and also ruffled and with light center stripe in both sepals and petals. The eye is darker and more sharply defined than in parent "Mahog."

Here I would like to repeat for emphasis that so far these reports are not from selected choice or unusual individuals from large families,

but are entire families, and the fascination is derived largely from the degree of variation within such very small numbers.

F-3 has proved itself valuable in further mating though strange to say the reciprocal family, wherein *Hyperion* was used as the seed-parent with pollen from F-3, there was no significant indication of the latter in any of the offspring. There was some variation in color from light lemon to rich banana, but all were yellow selfs of large size. One, subsequently named *Musette*, had oblanceolate petals, and one opened at dusk in the evening while the rest were normal day-bloomers. One of them burns white in hot sun while the rest are sun-fast. Thus do full sisters vary incomprehensibly.

At this point the English variety, *Iris Perry*, said to be derived from *Aurantiaca*, was brought into the picture and pollen of this used on "Thulva." From this union came the beautiful broad-petaled and ruffled-edge orange later named *Gipsy Lass*. "Mahog Sister" by *Iris Perry* gave the companion piece *Gorgio*, a bright yellow with near-white mid-stripe in the broad petals.

Next *Rajah* was admitted to the breeding lines, also *Vulcan*, but the former proved more valuable in that it contributed to reds of greater distinction, resistance to fading or burning, also freedom from rain spotting, as against such weaknesses when *Vulcan* was used.

Returning momentarily to the use of F-3 with *Rajah* as pollen parent the offspring tended generally to have long curly twisty petals far beyond the *Wau-Bun* type. Liking for this form depends largely on personal taste but I find some of them very charming and all of them interesting.

With this curly-twisty type in mind as largely derived from F-3 the next adventure called for mating it with *Duchess of Windsor* whose broad, regular, slightly ruffled Narcissus-like flower introduced a new element to the growing ancestral picture. What, for instance, would happen to the offspring when one strain attempted to pass on long curly-twisty petals, and the other, broad ruffled petals? The answer is now partly given in the gay ruffling of the extraordinary and unique *Fluffy Ruffles*. Most of its sisters inherit the broad petalage, and some degree of ruffling varying from the bouffancy of *Fluffy Ruffles* herself to the more regular marginal ruffling of fancy seamstress work found in one bright yellow sister.

Next step in this connected ancestral series is to see what will come out of a mating of *Fluffy Ruffles* with the rich vermilion red *Color Guard*. There is the suggested possibility of a broad-petaled bright red, extravagantly ruffled, sun-fast and free from rain spotting. Maybe it won't happen, but at least one is warranted by past experience to dream of such a creation anyhow. That is where much of the fascination of working with daylilies comes in. They are so utterly unpredictable as to detail and yet are almost certain to present new combinations of unfailing interest.

With the passing of time and the growth of interest and experience, larger families became the vogue so that report on all members of a family from here on would hardly be warranted.

“Thulva” and *Iris Perry* were bred reciprocally, and the ensuing families were recorded as families B and C respectively and may properly be looked upon as full sisters, as relationships go in the plant world, since they possess both parents in common despite their reverse status as father or mother. B-1 and C-2 of these families are not greatly unlike in their approach toward red but C-2 is more nearly self-colored, near Mahogany Red (Ridgway) whereas B-1 shows a darker and more defined eye.

B-1 bred with *Rajah* as the pollen parent, gave a number of fine reds, *Color Guard* being the best; runner-up a very large, slightly bi-color, flamboyant flower that although not officially registered, gets known in the garden as “Big Blowzy.” Other reds from this same source are generally sun-fast, neither fading or burning, and do not spot in the rain. On the other hand reds to maroons derived from a mating of C-2 with *Vulcan* are apt to fade or burn in hot sun, and spot easily in the rain. Another member of family C, C-3, became *Gipsy Lass*, an orange that is entirely unaffected by sun or rain.

All of which goes once more to enforce the fact that no one variety should ever be designated as a “good parent” by itself. It is the happy mating of complementary individuals that makes for good offspring be they Humans or *Hemerocallis*.

THE LEONIAN HEMEROCALLIS BREEDING STOCK

NELL LANHAM LEONIAN, *West Virginia*

Mr. Leonian became interested in flower improvement more than twenty years ago when he first became interested in delphiniums. His success with that flower led him to experiment with others which included *Iris*, *columbine*, and oriental poppies. Then in the early thirties he became acquainted with the beautiful daylilies in shades of yellow and bright orange which appeared on the market about that time. Later when he received a gift of a few reds his first thought was to try his hand at fusing the unusual color of the reds with the nearly perfect form of the yellows. This he did by a program of careful selection and cross pollination over a period of several years. As time went on he really became more interested in the development of color quality than in any definite form. However, his interest in color grew and as any shade, which seemed unusual, appeared, he made the best possible use of it in his breeding program to fix color. By the time his work ended, he had a great range of color in his plot. There were flowers of delicate peach, deep, bright orange and bronze at one end of the scale with exotic shades of pink, rose, red, and maroon at the other. As blossoms appeared on the new seedlings each year only the ones which most nearly approached his ideal of color were used as parent plants. Always the plants which were predominantly away from red or pastels were discarded.

The procedure he used in breeding plants decided Mr. Leonian's policy as to disposal of his product. He believed that he could im-

prove his plants with each year so that by the time any particular plant was ready for introduction it would be outmoded by the newer things in his garden. Therefore, he pioneered in the sale of daylilies as hybrids and did much to encourage the propagation of the plant by seeds.

Now that my sons and I are carrying on with the development of the unusual in *Hemerocallis*, we are using the same method but expanding the plot so that selection may be more exacting as time goes on. We aspire to the production of color tones that are true, rich, and unusual in a flower of excellent form whether the form be one of slender curving petals or of the frilled broad type. We expect the daylily to become more and more popular in American gardens as they improve in quality. There is no flower which requires so little care and special handling and at the same time makes an effective display for such a long blooming season.

MAKING NEW DAYLILIES

J. B. S. NORTON, *Maryland*

For about 20 years I have been interested in producing new daylilies and have here brought together some of the things learned as a brief outline of the process.

The philosophy back of the making of new kinds of *hemerocallis* begins in the creative instinct of man which may grow out of curiosity and desire to explore the unknown. The love of the beautiful also develops the artistic sense and the effort to produce beautiful things. There may also be the urge of competition, to try to do something bigger or better than others have. The satisfaction of having something that will please other persons may be another factor. Last, in descending order is the need for something to trade for the satisfaction of other needs or wants. There might be the higher feeling of cooperation with the divine in creation, but this is probably not often thought of.

But why work on daylilies rather than some other flower? 1st. The possibilities are great. There are a great many chances of making new combinations. 2nd. Their hardiness saves time, thought, and effort not needed for keeping them alive. 3rd. Their beauty and variety gives more interesting experiences to the producer and enables him to interest a greater number of other persons. 4th, The field is new and yet largely undeveloped and interest in the many types of flower has not yet become static.

After these thoughts on incentives, let us pass to methods. The first thing is to get material to work with. The more species, varieties and clones one has to cross and select from, the more chances there are of getting desirable new combinations. There is a feeling that one should go back to the wild species, which contain all the chances that exist, and that species are pure entities, while the garden varieties are artificial mixtures. But the species are only groups of individuals that some one thinks are enough alike to be considered the same. The more closely one examines the plants grown from the seeds of one wild plant

the more inheritable differences he can see in them. Some of the wild *Hemerocallis* plants may already have a hybrid constitution. Perhaps no one has yet inbred them enough to get pure lines for recrossing as is now done with the new high yielding kinds of corn.

Unless one wants to make an accurate scientific study of daylily characteristics, he should recognize his obligation to predecessors and start with their productions which may have already had eliminated from them some of their less desirable qualities. A collection of a few hundred clones, with the greatest variety of characteristics from a number of different sources will soon give one all he can do to find out what will come out of them.

If one is not too ambitious, a small back yard well organized, will yield enough to be worth while. If one makes *Hemerocallis* breeding a major project, one or more acres is needed. The type of soil is not important. Any ordinary farm or garden ground, easily worked, with moderate fertility and moisture is all right. Some shade on the south and west will help to bring out the more delicate colors of some of the most beautiful kinds. A small show garden on a main highway or near a city gives opportunity to exhibit the selected kinds grown under the best conditions. The production area can be on a not too distant farm. Compost or rotted manure with a little fertilizer is the best treatment. Though *Hemerocallis* will endure almost any conditions, and stand drouth, they respond well to good culture and plenty of water.

The best way to select varieties is to see them in bloom. In the show gardens they can be planted with plenty of room and arranged by height, colors or other attractive method, to show to the best advantage to observers. The named stock for propagation and distribution will have to be classified alphabetically or in some other way so they can be easily found. Few people can handle very many kinds by memory. Rhizomate kinds need plenty of room to keep them from mixing.

The most difficult part of the work is to keep a large number of kinds correctly identified in the garden. The slightest piece of a crown left in or on the ground may grow and contaminate later plantings on land supposed to be clean. Seed may fall down and grow in a clump and produce what might appear to be a sport. All kinds of accidents may happen. A plot-book with the location of each plant with record of its origin and character must be kept, and annual corrections made during the flowering season, and field labels placed and replaced continually. No kind of label that is entirely satisfactory has yet been discovered. A six to eight inch wooden pot label printed on with capital letters with a wax pencil will do for temporary use. Thin 1x12 inch stakes painted white and lettered with durable dark paint can be used for permanent plots.

One can decide on what kind of flower and plant he wants to produce. An ideal can be, and generally is, adopted to breed toward. This is logical and scientific, but strange to say, the nearer the ideal is approached the more interest is lost. One can go on without an ideal except to produce attractive and beautiful flowers, selecting every form of beauty that comes up out of the unknown. In any case you never

know just what you are going to get out of the thousands of genes shaken up in the hybridizing box. There are plenty of chances for elation and for disappointment, yet the more the offspring of definite parentages is studied the more certain the results become.

An easy way of working is to put the pollen from some excellent kinds on every kind you have and see what you get, but for more intelligent work, keep records of one or both parents.

If accurate pedigree records are not to be kept, the hybridizing methods are much more simple than most gardeners are led to believe. You can produce many hundred hybrid seeds in an hour, almost automatically, after practice, using the mind mostly for selecting what to cross. Start as soon in the morning as the anthers are open exposing the pollen. If records of parentage are not to be kept, a stamen from the selected pollen clone can be carried in the hand and the pollen touched to the stigmas of the intended mother plants until the pollen is all used, then another stamen is taken and used, and so on.

If parentage records are desired, hold a bunch of small string tags with three fingers of the left hand, with a short wax pencil in the right. After the pollen is applied the stamen can be held in the lips till the next flower, while an abbreviation for the pollen clone is written on the tag. Then with the thumb and fore finger of each hand the tag string is put over the tube of the flower, the tag through the loop and the loop slipped down onto the flower pedicel. The few chances of getting other pollen on the stigmas can be ignored.

When the seed pods begin to crack, generally while still green, they are gathered into envelopes on which the parentage is written and the seed shelled out then or later in the day, before they begin to dampen the envelopes.

The seed can be sown immediately, or in the fall, or winter, or saved till spring, either in the house or greenhouse, frame, or out doors. Planting them in the place where they are to grow until flowering, saves labor and avoids the check in growth due to transplanting, but the seedlings may be too close together or too far apart. If grown inside with favorable light and temperature and set in the garden in the spring, the time before flowering is often reduced several months.

The seedlings can be grown in rows just far enough apart to get between them, and three to six inches in the row. Most of them will be discarded when they bloom in two or three years, leaving the selected ones plenty of room to develop their full character. The term "seedling" is often applied to all unnamed plants, but it is not a very accurate term to so use.

Perhaps the most difficult process comes now, to decide which to save and which to discard. One should have independence enough to save what he likes. But if he is planning to put new kinds on the market, the beginner needs the advice of more than one experienced daylily grower, if for no other reason, to develop some artistic sense of his own by seeing how widely others differ on what constitutes excellence. The criteria laid down by noted breeders as to plant, season.

vigor, and other things, must be kept in mind. However, beauty of flower is the first consideration, and without it all other qualities are worthless.

A clone should not be considered fully evaluated until the clump has been divided and grown in a different situation for at least two years.

Many things remain to be sought for in hybrid *Hemerocallis*. A few improvements may be mentioned: purer pink, red, purple and white flowers, better resistance to climatic influences, longer blooming season, better early and late kinds, longer life of flowers, wider petals and especially wider sepals, bicolors with sepals darker, other color patterns, better surface texture, extension of the areas to other parts, a study of the characteristics of buds, bracts and leaves leading to a fine enough classification to enable the different kinds to be recognized when the names are lost and more cooperation between growers and breeders.

WHY NEGLECT THE NIGHT-BLOOMERS?

W. R. BALLARD, *Maryland*

As to blooming habits, daylilies may be divided into (1) day bloomers, (2) night bloomers, and (3) night-and-day bloomers. Probably the great majority of the existing varieties belong to the first class.

The second class which derives from *Hemerocallis citrina* begins to open its flowers "shortly before sunset, are widely open during the night, and they usually close early in the following forenoon especially on warm, sunny days." One of the earliest of the named varieties to be introduced was *Calypso*.

The night-and-day bloomers are characterized by flowers which open late in the afternoon and continue to remain open during the following day or longer. Norton's *Woodridge* is a good example of this class.

Who has worked out the genetics of the night-bloomers? Is this a dominant or recessive character? Is it possible that the night-and-day bloomers are the result of crossing the day and the night bloomers? If true, may this not be the lead for developing varieties with flowers which remain in good condition over a longer period than those most of the standard varieties?

Daylilies make very satisfying flower arrangements either with blended colors or with sharp contrasts. For evening decorations, however, most of the present day varieties are a wash-out. They either go to sleep or lose their brilliant coloring so that their appearance is anything but pleasing. Here is where the night bloomers come into their own. Opening, as they do, late in the afternoon they still have their fresh beauty unimpaired. Most of the clones of this group which I have seen are varying shades of yellow or bi-colors. It would be a distinct advantage if the color range could be extended to include the reds and pinks.

Logically, of course, the type which should be developed is that of the night-and-day bloomers, for the night bloomers are a disappointment as far as their garden effect is concerned, since for most of the way they are quite unpresentable.

If anyone has worked out the method for developing the night-and-day bloomers, it would be a worthwhile project for daylily breeders to set about increasing the range of color, and particularly good substance. From my observations it appears that many of the night bloomers have very poor substance and are easily injured by rains or exposure to the hot sun.

It may be a mistaken idea that most daylily breeders are considering only garden effect in the development of this popular flower, but it would seem that the necessity of increasing the popularity of the daylily by providing suitable types for house decoration or flower shows in the evening has largely been overlooked. At any rate it would be interesting to have a fuller discussion of this phase by those best qualified by knowledge and experience to give the facts.

DAYLILY BREEDING AS A HOBBY

LEWIS A. HURST, *Maryland*

The question most frequently asked by visitors to our *Hemerocallis* garden is why I chose the hybridizing of daylilies as my retirement hobby—and hobby it is for at no time have I been interested in its commercial returns. The answer is that I had begun some of this work on a very small scale a few years prior to retirement and found very fascinating the study of the infinite variation in form, color, color combinations, texture, habits of growth, and temperamental reactions to weather conditions, etc., which are characteristic of this plant.

After retirement, I had anticipated growing no more than one or two hundred seedlings each year, but a sunny vacant lot of about a third of an acre with rich soil was my undoing. Daylilies were less care and certainly added more to the landscape than rag weeds and tall grasses that had to be mowed and burned over each spring. So in the last three years the greater part of the area has gradually come to be a late-May-to-August color picture composed of plants purchased from other growers for breeding, and my own hybrids, blooming in very great profusion, many of them for the first time. The most interesting to me, however, are our own seedling selections which we each year single out as the choice of the new crosses, and grow on until better ones arrive to take their places.

I plant the seeds in the fall before the ground freezes—late October usually—planting the seeds in two to three inch bands (rows), twelve inches from center to center of rows thus reducing the weed hazard by more perfectly shading the ground. During the first season, I thin out and transplant some to vacancies where germination fails, or where premature plants are killed by freezing when unseasonably warm weather in late fall causes too early germination. However, in general

the plants grow on as planted. We get about forty to fifty per cent bloom the second season after crosses are made. Because of the crowded conditions in the seed bed, we usually allow the plants to bloom for about three years when practically all of the plants will have shown colors. But in the meantime a partial thinning out process is practiced in two ways; one by relegating to the compost heap at once the plants whose blooms show but little promise, and the other by transplanting a few selections from each year's crosses to the trial plots for growing on for further study. Some of the methods employed may be open to adverse criticism, I know, but they have served very satisfactorily in the case of such a temporary garden as ours, operated without outside help.

An ever-changing, unpredictable color patch as our daylily garden is an exciting hobby every day from the first blooms in early spring until the last flowers pass out with the early freezes in the fall. The peak of bloom occurs in July.

No doubt many others who are working with this pastime are deriving as much pleasure from it as we have. We entered the game for the fun of it and the outdoor exercise that it offered, but now at 73, I plan to operate with greatly reduced numbers of seedlings, using for hybridizing, chiefly the choicest from our own breeding efforts, some of which are quite promising, or at least, very interesting.

FOUR HYBRID DAYLILIES

C. W. CULPEPPER, *Virginia*

In 1946 Herbertia, the present writer described very briefly his first four hybrid daylily introductions. These are considered a little more in detail in the present paper along with some thoughts on ideals and methods in daylily breeding.

Adventure. The yellow day lilies have long been of such excellence in many respects that not as much attention has been given to their further improvement as they deserve. Any seedling with superior qualities in any respect therefore should be noted and considered in any selection work. The variety here described is the result of many years of crossing and selection. It has been named *Adventure* because it is the first variety introduced in my adventure into the unbounded realm of daylily improvement. It is a third or fourth generation descendant of *Patricia* x *Stalwart*. Of its many excellent qualities it is most noteworthy for the finish and texture of its flowers, being considered delicately attractive in this respect. The color of the petals and sepals is Deep Chrome to Cadmium Yellow of Ridgway. The flowers open widely the petals curving gracefully outward being only slightly reflexed. The margins of the petals are somewhat frilled which makes the flower free of the stiff formality characteristic of some of the yellow varieties. The flowering stems are three to four feet tall, moderately stiff and well branched. The plant is a good grower but responds well to good culture producing an abundance of large flowers under such treatment. It sets

seed freely with the pollen or many other varieties which offers opportunity for combining its good characteristics with those of other varieties to obtain still better forms.

Big Glory. The variety *Ophir* has long been a standard of excellence in growing habits. It thrives under a wide range of soil and climatic conditions producing an abundance of flowers upon sturdy well branched stems. Its flowers do not open as widely as might be wished and are sometimes considered a little coarse. It sets seed sparingly, crosses with it being difficult to obtain. It, therefore, seems that any variety having the good growing habits of *Ophir* but with a better quality of flower would be very desirable. It is felt that the variety here described is a step forward in the improvement of the *Ophir* strain. It has been named *Big Glory* because of the large size and beauty of its flowers. It is seedling of *Ophir* crossed with an unnamed seedling. The color of the flower is Capucine Yellow to Deep Chrome of Ridgway. The form and finish of the flower is different from that of *Ophir* and is considered to be an improvement by many. It is semi-flaring, large, often having a spread of seven to eight inches and borne upon sturdy well branched stems. Its flowering season is the same as that of *Ophir*. It sets seed sparingly but somewhat better than *Ophir* which gives opportunity for further improvement of this strain.

Albedo. There is a very great need for better late varieties in all color groups. One might endeavor to secure these by crossing the mid-season varieties with the small flowered late multiflora and from the seedlings select the large flowered late types and inter crossing these and their progeny until the desired forms appear. Another method would be to inter cross the latest large flowered varieties and from these seedlings select the latest good forms as parents for a second generation and so on. I have not had much success with the first method though not enough has been done to disparage the method. However, I have developed some midseason late strains right out of the midseason varieties. These seem to be useful for further work as well as being equally useful as garden ornamentals. One of these is *Albedo*, so named not because of its whiteness but because the flower reflects the morning sunlight somewhat suggestive of the manner of reflection in freshly fallen snow. It is a midseason late in flowering habit blooming at the same time as *Dorothy McDade* from which it differs widely in form, finish and texture of its flowers. The petals are a light yellow being close to Pinard Yellow of Ridgway and their margins are moderately frilled giving the flower an airy appearance. The flower is spreading with a very short throat in which almost no green appears. The petals are one to one and one half inches wide and curve outward without being rolled back appreciably. It is of complex parentage, not entirely known, but having the blood of Hyperion in its ancestry. It sets seed rather sparingly but enough are produced to appear to be useful in further development of late varieties. It is introduced with the hope that it may be useful to some breeder as well as give a bit of pleasure to some lover of this favorite flower.

Acceptor. One complaint against the *Hemerocallis* is that the flowers last only for one day. It is recognized by all that to a large extent this is compensated for by the production of flowers that open successively over a considerable period of time. However, the length of the flowering period does vary very greatly in different strains. Often the selection of varieties is made upon the color and form of the flower and the length of the flowering period is very largely left out of consideration. The variety here described is so outstanding in the length of the flowering period that it has been thought worth while distributing it for this character alone. *Acceptor* of course has many other good qualities. It was so named because it accepts pollen from a remarkably large number of varieties giving well developed pods with good seed. In 1946 the pollen of more than thirty varieties was applied to the flowers of *Acceptor* with two or three varieties only failing to work successfully. The length of the flowering period is shown by the fact that in one year the last flower of Queen of May was used to pollinate the first flower of *Acceptor* and the first flower of August Pioneer was used to pollinate the last flower of *Acceptor*. It is a seedling of *San Juan* x *Theron* and it has many of the characteristics of both parents. It has the sturdy stem of *San Juan* and the excellent branching habit of *Theron*. It has the deep green vigorous foliage of *San Juan* and the good growing habits of *Theron*. The flower is usually deeper in color than either parent. The color is Blackish Red-Purple of Ridgway. It has a light yellow throat and a light yellow line lengthwise through the center of the petals. Like both its parents it fades considerably with full exposure to sunlight on very hot days. It does not replace either of its parents but does combine many of the qualities of both. It is too early yet to say how far the long-season blooming habit is transmitted to its offspring.

SELECTIVE HEMEROCALLIS BREEDING AT THE UNIVERSITY OF FLORIDA

JOHN V. WATKINS, *University of Florida*

In the early thirties, selective breeding in *Hemerocallis* was begun by John V. Watkins at the University of Florida. Early in the work it seemed to this hybridizer that there was a real need for a strain of dwarf evergreen plants that would bear tiny blossoms of cherry-red during early April. By carefully controlled cross-pollinations, several generations of plants have been produced which have yielded thousands of seedlings. From these, two sisters have been selected which most nearly approach the ideal which was set up at the inception of the project. It is hoped that a sufficient stock may be worked up so that these seedlings can be described, named and distributed in the Deep South by 1950.

Another family of plants was utilized in an attempt to produce a fast-growing, evergreen daylily that would bear flowers of 'mulberry fruit' color on four-parted scapes early in April. *Theron*, *Persian Prin-*

cess and *Black Falcon* all of which are deciduous, very reluctant growers and very late bloomers, in Florida were used in original pollinations. About five generations have now been bred, and many promising ever-green seedlings may be viewed in the seedling plots. None of these show all of the characters that this hybridizer wrote into the original hypothetical description. It is planned to continue selective breeding within this family of blacks.

ECONOMY IN GROWING DAYLILY SEEDLINGS

J. S. COOLEY, *Maryland*

Any short cut in growing daylily seedlings should be very acceptable to the amateur breeder of which there are more and more every year. The necessary work for growing a few thousand of daylily seedlings to flowering is at best considerable. If one has a new crop of seedlings every year to work over one soon begins to look for every possible labor saving device.

The writer has tried several methods of sowing the seeds and growing the resulting seedlings with varying degrees of success. Sowing the seeds in a bed outside in early fall was not satisfactory, because many of the seedlings emerged that fall and suffered winter injury and many of them actually died. Sowing the seeds in a cold frame in the fall largely overcame this difficulty but transplanting the seedlings in early spring entailed too much work. There was the additional objection that the seedlings were often transplanted too early and were injured by a late frost. Very young seedlings that emerge in late fall may die of winter injury when more mature plants would not have been affected. Likewise it is common knowledge that a thoroughly hardy plant may be killed by frost when it is taken from the warmth of a cold frame and exposed to even light frost. Another method was to sow the seeds outside in the spring, but this has the objection that any seeds that require a cold treatment to make them germinate do not emerge that summer.

The method finally adopted was to sow the seeds outside in November late enough that they will not germinate that fall. The seeds are sowed rather thickly (several to the inch) in rich friable soil and covered about 1 inch deep with rotten compost such as that made from a rotting pile of brush. The seedlings emerge in the early spring. A fine stand is almost always obtained. They are left in the seedling rows the first summer. The rows should be at least 2 feet wide. The next spring the seedlings are transplanted as soon as danger of the ground freezing is over. This method has the advantage of eliminating during the first winter and before transplanting any that are frost tender. It also precludes the possible loss of some young seedlings that are naturally hardy and are uninjured when left undisturbed in the seedling row. Transplanting in the second summer has the added advantage that it usually saves one year of cultivating and caring for the transplanted seedlings cover a larger area.

When the seedlings are transplanted to their permanent location they are set as close as possible and still allow for proper development, which is about 3 to 4 inches apart in the rows that are spaced 8 to 10 inches apart. With a fertile soil and good culture most of the seedlings will have bloomed by 2 years after transplanting. The ones selected, if any, can be removed for further observation and the rest discarded.

It may seem a pity to destroy all but the few that show promise of being better than any already in cultivation. Such a practice must of necessity involve the destruction of some high quality plants. It is much better however to destroy some that may be nearly as good as the best than give out for public distribution clones that may be less than the best.

A daylily planting may last for many years and for that reason the initial planting should be as good as is extant at that time. Furthermore it requires no more space or care for a good daylily variety than for a poor one. It seems to me therefore that the practice of distributing unproven seedlings tends ultimately to injure daylily advancement.

DOUBLE DAFFODILS ¹

ORNATUS, *England*

As plants for garden decoration pure and simple, the double Daffodils are no doubt less desirable than the more plentiful single types, as they are more liable to damage, owing to the weight of the flowers, from strong winds or heavy showers. Nevertheless, they are of considerable use and deservedly popular as cut flowers for vases, or grown as pot plants, or in fibre in bowls, while the old yellow *Narcissus Telamonius* var. *plenus* is largely used for naturalizing in woodland and outlying parts of the garden, and is one of the few doubles that may be forced for early use.

Another old variety, also useful, very beautiful, pure white, and sweetly-scented, is one that flowers at the other end of the season, viz. in May, the "Gardenia-flowered" *Narcissus poeticus* var. *flore pleno*. This does best when planted in deep, moist soil and allowed to become established; unless these conditions are allowed for, it has a tendency to go blind on occasion. An earlier double white is the variety *Daphne*, one plant of which was originally found by Mr. Culpin, of Spalding, among a batch of *N. poeticus* var. *ornatus*, from which it was no doubt a sport. From this one plant has been worked up what must be a very large stock, and the bulbs may now be obtained for about a shilling each. These double white varieties have a high value for market and florists' purposes, being largely used as a ground work in wreaths and floral designs.

To Mr. W. F. M. Copeland, of Southampton, belongs the credit of having raised improved varieties of double Daffodils. His variety *Mary*

¹ Reprinted by permission from *Gardeners' Chronicle* (London) 106:118-119. 1939. The illustrations that accompany the article were kindly furnished by Jan de Graaff, Sandy, Oregon.



Hybrid *Narcissus*—*Irene Copeland*.
Photo by Jan de Graaff



Hybrid *Narcissus* -*Cheerfulness*
Photo by Jan de Graaff



Hybrid *Narcissus*—*Twink*
Photo by Jan de Graaff

Copeland, raised, he tells me, from an un-named *poeticus* x *Orange Phoenix* (or *Eggs and Bacon*), is probably the most beautiful and popular of the whole double-flowered race. It is a flower of very perfect and symmetrical form, the encircling petals being creamy-white, and the inner ones orange-red and creamy-white, alternately distributed, building up a remarkably brilliant and attractive flower, which seldom fails to obtain highest honors when exhibited. Mr. Copeland has raised a good many other doubles, but the best known and most frequently seen of these are *Irene Copeland*, lemon and white; (Plate 308); and *Mrs. William Copeland*, a large, substantial, full flower of pale color which is a very strong grower and long laster. When referring to *Irene Copeland* I ought to have said that it is valuable for its earliness and its amenability to forcing.

The late Mrs. R. C. Backhouse raised several doubles, the best known of these, perhaps being *Texas*, an enormous red and yellow flower; *Fiery Knight*, and *Insulinde*, of brilliant coloring; the latter variety gained a First Class Certificate at Haarlem in 1934. It was in evidence at the R. H. S. Meeting on March 7 this year [1939], and appealed to me as very striking; I should term it a semi-double, of wide and spreading form and rich coloring; I noted it as quite an outstanding variety.

The late Rev. G. H. Engleheart, in his later years, raised several fine double white Daffodils, of which Engleheart's *Carnation* (A. M., R. H. S., 1933), and Engleheart's *White Rose* are examples; the latter was awarded the R. H. S. First Class Certificate, and is perhaps the most beautiful double-white Daffodil yet seen.

A Daffodil that has recently become remarkably popular is the double *poeticus* variety *Cheerfulness* (Plate 309), which originated as a sport from Van der Schoot's *Elvira*. The coloring is creamy-white and yellow; besides being an attractive border plant, it does well in pots or bowls, and is a favorite in the markets, being very effective when "boxed".

A very large and full flower of soft yellow color which has been in good form at the shows this year (1939) is *Inglescombe*, introduced by the late Mr. J. Walker so long ago as 1914, while *Primrose Phoenix*, another somewhat of this type, is of soft lemon coloring and looks attractive in a vase; there appears to be no record of its raiser, but it gained an Award of Merit so long ago as 1902.

Holland's Glory, introduced by Van Leeuwen, has been stated to be a double sport from *Emperor*; when at its best it is a fine exhibition flower, but at times it comes rather coarse and unshapely. A double not much seen now is of Mr. W. A. Watts' raising, *Linos* by name; it is interesting to Daffodil breeders by reason of its unusual pedigree; it was raised from a cross made between *Beacon* and *N. Telamonius* var. *plenus*. Here I am reminded that Mr. Copeland tells me that in his experience the product of first crosses made with *N. Telamonius* var. *plenus* are usually of doubtful constitution, whereas the second generation gives more vigorous and stronger-growing plants.

A double raised by de Graaff and named *Twink* (Plate 310), is a desirable variety, more especially by reason of its forcing qualities; I have seen it exhibited in good condition quite early in the year; it is a flower of pale yellow, deepening to orange in the center, and is a good border or decorative variety. *Argent* and *Dubloon* were two of Engleheart's earlier raising; the former is a graceful semi-double and a nice cut flower of soft yellow and white, while the latter, from a cross made between *N. poeticus* var. *ornatus* and *N. Telamonius* var. *plenus*, is of similar coloring but more double; this variety makes a notably pretty group when naturalized.

A pretty semi-double, pure white, a late flower with very long stems, is *Triplex*, which I do not think has been seen at the shows here since it gained an Award of Merit at Chelsea Show in 1929, as the stock went to Holland; it also took a similar Award at Haarlem in 1938 and it is a somewhat Camellia-like variety with rather flattened, snow-white petals, symmetrically arranged. It was raised by Mr. F. Herbert Chapman, its parents being *Moonbeam* and a *poeticus* seedling, from which cross came several other semi-doubles. It is interesting to speculate on the why and wherefore of doubles (or semi-doubles) coming from such a cross as this. Some people tell us that the late double white (or Gardenia-flowered) came as a sport from *N. poeticus* var. *recurvus*, and as the latter was one of the parents of *Moonbeam*, it might be suggested that there was a family tendency here to throw doubles; but this, of course, is pure speculation.

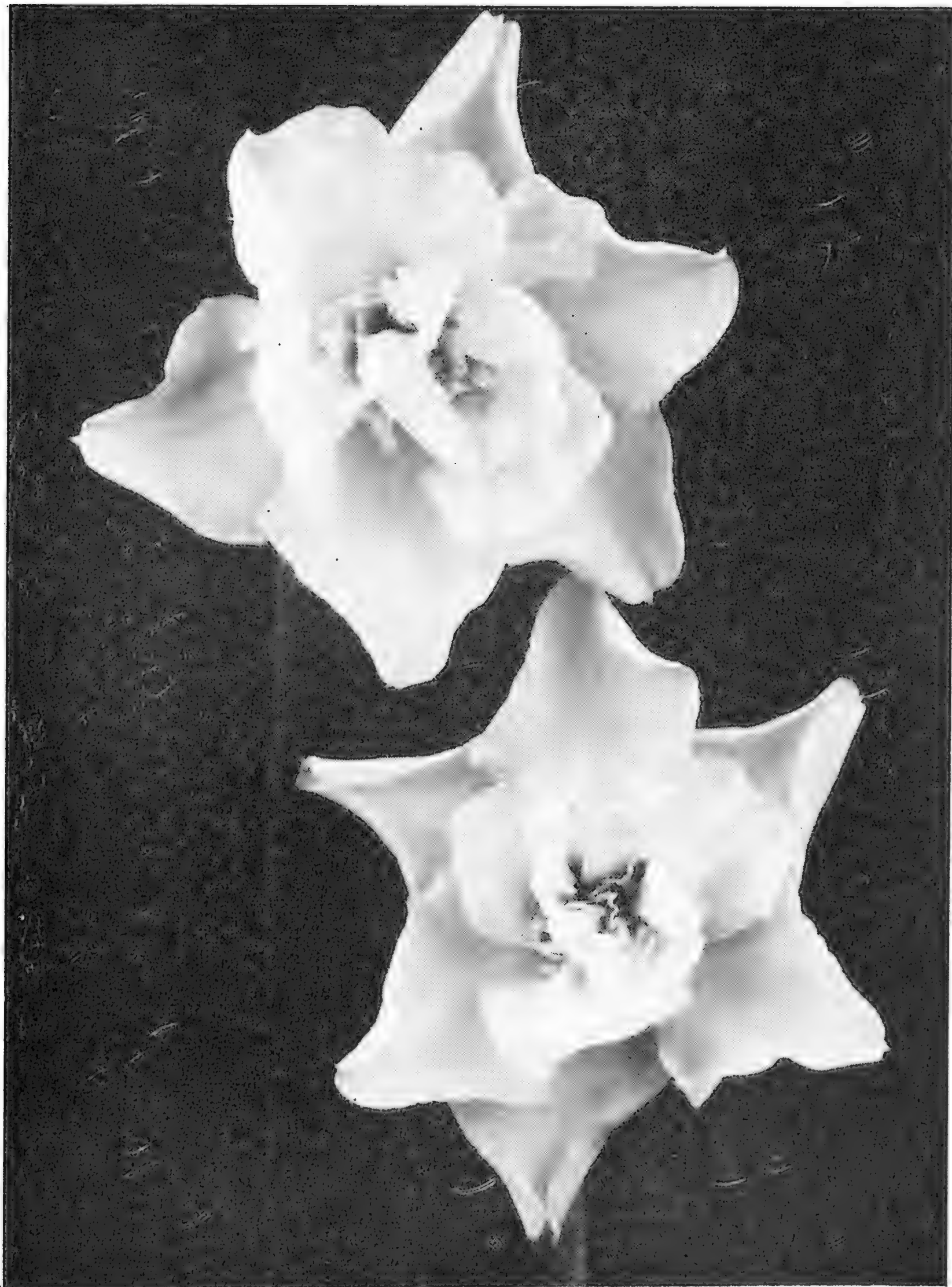
Before closing, I cannot omit mention of the old *N. cernuus* var. *plenus*, reputed to be a native English flower, and now very scarce and greatly prized, a graceful and beautiful silvery-white variety. Many will remember that great Daffodil lover, the late Miss Ellen Willmott, could sometimes be seen wearing a posy of it; it is difficult to keep or establish unless planted in a shady spot in pure loam, but such a gem is well worth taking special pains with.

In what is written above I have, I think, included the double Daffodils most frequently seen and most popular, but the list does not profess, of course, to include them all, and space forbids more than a mere mention of such varieties as *June de Miel*, delicate and graceful, white, with a yellow center; *Rip-van-Winkle*, a scarce little yellow double; *Snow Sprite* (Plate 311), and early double, white; the old *Codlins and Cream* and *Eggs and Bacon*, and a few others now seldom seen.

AMARYLLIS BREEDING IN THE NORTH

STANLEY JOHNSON, *Pennsylvania*

It is a fascinating thought to realize that we are able to assist in the development of new varieties of plant life and there is that certain pride resulting from successful plant breeding. Possibly you have heard the expression "Let the hybridizing to the experts while the amateur should grow the species and endeavor to obtain near perfection." Considering that the breeding of most plant life is not too complicated,



Hybrid *Narcissus*—*Snow Sprite*
Photo by Jan de Graaff

every amateur could do some hybridizing and obtain successful results.

There are several methods of obtaining new varieties. The first is by cross-pollination which undoubtedly is the most successful and reliable method. The second is by the discovery and selection of mutations or so called "Sports". This method is very uncertain and does not frequently occur in most plants. The last plan is by using the chemical colchicine. This drug increases the chromosomes of the plant. This technique is also uncertain and still in the experimental stage, until more scientific data is available it will be wise to leave this method to our scientists.

If you are interested in breeding any certain species of flowers, it is well to select at first a plant that is of simple construction and the essential organs are easily identified. My suggestion is working with *Amaryllis*. This flower has already proved itself to be of great value for study to botany students. After you have gained the knowledge and art of breeding you then can apply your experience to hybridizing other kinds of flowers.

It is possible that in the near future one of our experts on the *Amaryllis* will give us a point scoring system or a "standard of perfection" so that it will be possible for one to evaluate his results and achieve a scientific rating. This could be based on the following score-card, which I am submitting for consideration.

STANDARD OF PERFECTION SCORING SYSTEM

20	<i>Color</i> -Bright, attractive and useful minus 4 dull; -3 fades; -2 not attractive.
15	<i>Form</i> -Uniform and artistic; -4 deformed; -3 ordinary; -2 varying.
5	<i>Distinctiveness</i> in color, form etc.
20	<i>Size</i>
10	<i>Stem</i> -Strong, long, erect and in proportion; -3 weak; -3 crooked; -3 out of proportion.
10	<i>Foliage</i> -Healthy and in proportion; -5 poor weak; -3 poor proportion.
10	<i>Substance</i> -Petals firm and thick.
10	<i>Floriferousness</i> -Profuse and early; -3 shy; -4 late.

TOTAL SCORE, 100

This would eliminate the inferior varieties selected on the basis of first impression, or so called "I like it" varieties. The breeder would then have a good chance of developing new varieties of merit and distinction—better than existing standard varieties. It would also enable one to follow some certain line of breeding. The standard of perfection would be a most valuable guide to all growers. One would be able to definitely know what specimens are the ideal or perfect types, and the score card could be used as a "Yard-Stick" measure to rate ones seedlings.

When one comes to the actual work of hybridizing, the tools should consist of a small camel's hair brush and a pair of small tweezers. One's

selection of the plants or foundation stock should be made after careful study. It will be wise to buy only plants of the best varieties conforming to standards of the flower such as form, dimension and color.

The *Amaryllis* flower has a pistil and on the end is the stigma. Usually there are six stamens. Select some individual bud then watch for the expanding of the pedals. When the bud has opened, use the tweezers to nip off the six anthers atop the stamens which have not as yet discharged any pollen.

The next day examine the flowers and one will notice that the stigma has expanded or grown larger. The following day the stigma should be "receptive" so that pollination can take effect. One now must have another plant, the flower of which is in full bloom unless you have facilities for storing pollen. This will be your pollen plant so with your tweezers remove the anthers letting them drop into a very small box or saucer. Take your brush and carefully transfer this pollen from the anthers to the brush. Then apply the pollen directly on the stigma of the seed parent. If the pollen has "taken" it will be apparent after a short time by the enlarging ovary at the base of the pistil. It is wise to indicate or mark the plants used for breeding. They can be named or code numbered. Tie a small tag to the stem of the hybridized flower, showing the parentage. Mark tag as example (Seed parent X Pollen Parent), the letter X indicating "crossed with".

After the seed-pod has ripened and has almost dried it must be removed. The seed should be cleaned and they should be left to mature for a week by spreading on a low flat cardboard box. Keep away from direct sun light. The seed then can be placed in a small wood or paper box for storage until ready to use. Damp seed will quickly mildew. I prefer to immediately plant the seed in a medium of "vermiculite" or expanded mica. This is usually indoors or under glass during the summer months. The seedlings are kept growing during the winter months and planted in the garden in early May. *Amaryllis* prefer a light soil and irrigation is required during the dry summer months. The bulbs are dug in the fall, stored dry in a basement and again planted in the garden. You can expect most of the bulbs to flower the third year.

When the flower appears one will know the results of one's work. Each flower should be checked, scoring it with the "Standard of Perfection". Those that do not score 85 points should be destroyed. It is far better to get one or two outstanding new *Amaryllis* than to save 50 or more that show no improvements over existing varieties. One must work with the thought of progress toward developing superior strains.

PICOTEE HYBRID AMARYLLIS

TH. HOOG, *Haarlem, Holland*

It is perhaps fifteen or more years ago that the writer noticed amongst a batch of large-flowered white hybrid *Amaryllis*, at Messrs. van Tubergen's "Zwanenburg Nurseries" at Haarlem, Holland a plant



Fig. 183. Picotee Hybrid *Amaryllis*. Photo by W. J. van Borselen, Haarlem.

which was distinguished by a distinct narrow red rim along the edges of the segments. The flower itself was of poor quality, the stem was very weak and it carried but two flowers. By fertilising it with pollen of a variety which more or less had developed the same character, seed-

lings were raised which were of slightly better quality than the original plant. At first many plants appeared which besides the desired narrow pink edge also had reddish or pink stripes near the centre of the flower. These were eliminated and by always saving seeds of the best varieties, gradually great advances have been made. At present the flowers are fairly large, they have much substance, they are well-opened and the segments overlap. The colour is a pure white throughout with only a distinct pink rim on the edges. (Fig. 183) Although the majority have about three flowers on a spike, it is hoped that ultimately varieties with four flowers, out at the same time, will appear.

Like the pure white *Amaryllis* these Picotees flower quickly from seeds. A batch of seedlings of 1944 is just starting into flower—May 21st. 1946—so exactly two years after the sowing the first flowers opened. Owing to the difficulties of the last years they have not been grown so well as ought to have been done. The batch consists of 300 plants. In flower now are 20 plants, with only one rogue, all others true to type. As all growers of *Amaryllis* know, generally the coarsest types flower first, if therefore of a new batch of seedlings all the first bloomers are true to type, it may be assured safely that the strain is fixed and will breed true to type from now onwards.

ZEPHYRANTHES GRANDIFLORA LINDL.

HAMILTON P. TRAUB

Zephyranthes grandiflora was first described by Lindley (Curtis's Bot. Mag. 902.) and the later names *Z. carinata* Herb. and *Z. Tsouii* Hu are therefore synonyms. *Z. grandiflora*, according to Sealy (1937) is native to the West Indies and Guatemala; Hume (1935) attributes it to Mexico.

Hume (Torrey Bot. Club 62: 404-405. 1935) has pointed out that "4-merious development, five stigmas and other abnormalities are so frequent in *Z. carinata* (= *Z. grandiflora*) as to be almost characteristicit may be a clone, perhaps a hybrid." The writer has recently had the opportunity of studying a number of individuals of this species (or ramets, in case it should be a clone), and on the basis of the material studied, Hume's statements are amply verified as shown in Table 1.

This evidence apparently supports Hume's conclusion that *Z. grandiflora* may be a clone, and in addition the clone may be subject to somatic bud mutations giving rise to various anomalous forms from the same bulb as shown by bulb No. 8 above. It appears to be very desirable for residents of Mexico and Central America to re-collect this species in its native habitat so that its status may be clarified. The form that we know may not be representative of the biological type of *Z. grandiflora* and may be a clone.

Vasku, in an article appearing elsewhere in this issue, mentions that one seed capsule set on one plant of *Z. grandiflora*, apparently by self-pollination, but as indicated in Table 1, the writer has up to the present obtained only one seed capsule by applying pollen of *Z. P. I.*

No. 110688. Whether this is a real cross, or is only parthenogenetic development will be revealed only after the seedlings flower.

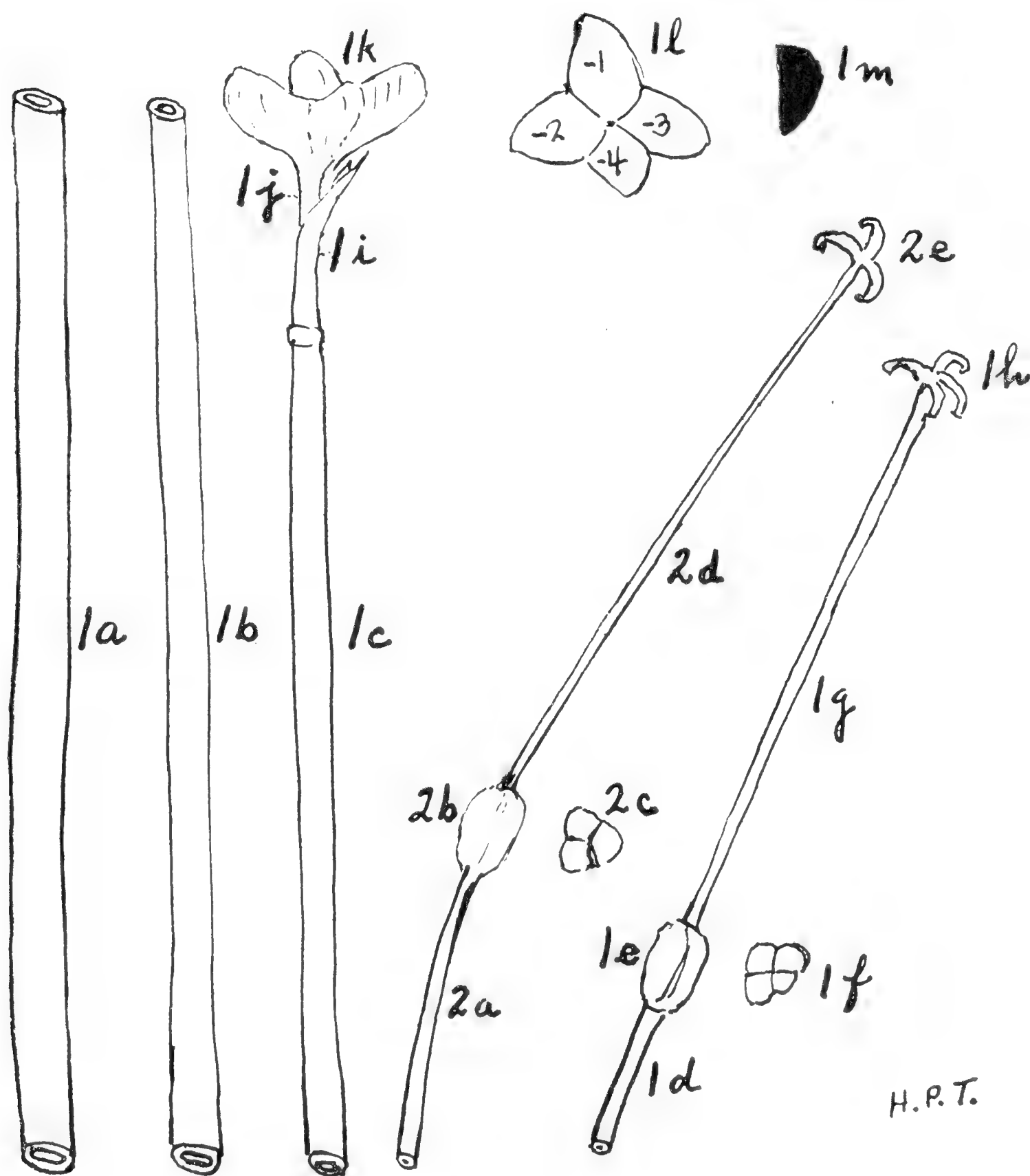
Since the plant in cultivation as *Z. grandiflora* rarely sets seeds, it was thought desirable to reproduce a drawing of the gynoecium and fruit. This is shown in Figure 184. The gynoecium and fruit are described below, on the basis of the two flowers from bulb No. 8.—

Table 1. Flowering characteristics of *Zephyranthes grandiflora*

Bulb No. (ramet)	No. of tepalsegs	No. of stamens	No. of stigmas	Remarks
1	9	7	4	2 tepalsegs added on outside of regular perigone; 1 added on inside.
2	6	6	4	one stigma smaller than others.
3	6	6	3	No abnormalities.
4	6	6	3	No abnormalities.
5	9	10	8	3 tepalsegs added on inside of perigone; one stamen with tepal-like appendage; style compound, made by union of 2 styles; stigmas of various sizes.
6	8	8	4	2 tepalsegs added on outside of perigone; one extra stamen united to center of a tepalseg.
7	6	6	4	One compound filament from union of two, but with only 1 anther.
8	7	7	4	First flower,—seeds set after pollen from <i>Z.</i> No. 110688 was applied; capsule with 3 larger locules, and one smaller (See Fig. 184.)
8a	6	6	3	Second flower,—normal flower produced from bulb No. 8, above, about 12 days later.
9	7	7	3	Tepals added on outside of perigone.

Scape elongating after anthesis and reaching a final height of 30.5 cm.; peduncle 29 cm. tall, somewhat flattened, 6 X 3.5 mm. at base, tapering to 4 X 3 mm. at top below pedicel; spathe 1.8 cm. long, pedicel variable in length 2.5—3.5 cm. in normal; 1.5—2 in 4-merious stigmas; 3 mm. in diam.; capsule deeply lobed 1.8 cm. wide, locules four, one distinctly smaller than the others; seeds D-shaped, 9 mm. long, 4.5 mm. wide, black, not winged, 10 sound, 6 rudimentary seeds in locule No. 1,

Fig. 184, 4 sound, 11 rudimentary in locule (No. 2), 4 sound, 10 rudimentary in locule (No. 3), and 3 sound, 6 rudimentary, in locule (No. 4): ovary 3-celled 8 X 5 mm. (4-celled in 4-merious types, 8 X 5 mm., one cell smaller); style 5.5 to 7.0 cm. long, 1.5 mm. diam. (1.5 mm. diam. at base in 4-merious types at top); stigmas 3, 4 mm. long, recurved (3 mm. long in case of extra stigma in 4-merious flowers).



H.P.T.

Fig. 184. *Zephyranthes grandiflora* Lindl. 1-d to 1-h, pedicel and flower (perigone removed), with 4-merious stigma; 1-a to 1-c, same, with peduncle, after maturity (no. 8, in Table 1): 1-a, 1-b and 1-c, sections of peduncle that is somewhat flattened; 1-i, spathe; 1-d and 1-j, pedicel; 1-e, exterior view of ovary, 1-f, cross-section of ovary; 1-g, style, thickening slightly toward apex; 1-h, 4 stigmas, one somewhat smaller; 1-k, ripened capsule; 1-l, cross-section of capsule, showing four locules (-1, -2, -3, -4), one locule (-4) somewhat smaller; 1-m, seed. 2-a to 2-e, 3-merious, or normal flower (perigone removed). All approximately natural size.

DAYLILIES AT WHITNALL PARK

JOHN E. VOIGHT, *Acting Supt.*,
Botanical Gardens, Whitnall Park,
Hales Corners, Wisconsin

This is one of the Midwest's great display gardens which is gradually becoming a cultural center for this area. The gardens are extensive, and include a perennial garden, an annual garden, a rock garden, a rose garden and shrub mall, consisting of plantings of many descriptions. Some are laid out formally, others are informal but everywhere much attention has been given to providing everything in which the people of this community might be interested.

One of the many outstanding attractions is the DAYLILY TRIAL GARDEN (in cooperation with the AMERICAN PLANT LIFE SOCIETY) consisting of more than 125 clones of the newer introductions. Due to the war and post war conditions, it has not been possible to accomplish much with reference to expansion, although we have acquired a few named clones in the past year. At present, we are in the process (October 1947) of enlarging the daylily location, which will result in a better presentation, not only from a display viewpoint, but also from an educational one. We have made an effort, and will continue to do so, to bring together as complete a collection as possible, of the finer daylily clones available today. Our attendance this year will reach the half million mark which proves clearly that the people of this area are extremely interested in plants and are very fortunate in having been able to make possible such a modern horticultural and botanical center.

In conclusion we wish to thank all of those who have so unselfishly contributed to the gardens here at WHITNALL PARK. We are always pleased to receive your comments, as well as your suggestions for improvement. With best wishes for a successful Hemerocallis year, we remain until the next report in 1948 HERBERTIA.

4. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION, IRRIGATION,
USE IN LANDSCAPE, DISEASE AND INSECT CONTROL, ETC.]

NOTES ON DAYLILY CULTURE

GEORGE GILMER, *Virginia*

Over three thousand daylilies have been named. It is safe to assume each hybridizer thought his darling a wonderful plant. My experience has been varied, 83% of one hybridizer's plants I rate A, and 20% of another's, and others in between. The conscientious worker tests each plant thoroughly and in different states and names and offers the public less than one in a thousand of his seedlings.

Some grade A plants of any hybridizer I know can be bought for \$3.00 and sometimes less, while almost all except one ask up to \$25.00 for some of their newest. Personally, I feel every plant WORTH \$25.00 is so valuable that it should be kept exclusively for breeding and increasing until they are sufficiently plentiful to meet the demands at not more than \$5.00. But if I had raised over a thousand pedigreed seedlings to get a worthy, I might want \$25.00 or more for each rament to repay part of my labor and expense. Most successful hybridizers work mainly for the pleasure of creating an artistic masterpiece—but even artists must eat.

Either buy plants you have seen blooming after 4:00 o'clock in the afternoon or select those introduced by a reliable breeder. Some plants that are beautiful in the morning are unattractive by 4:00 P. M. Do not condemn plants or rate them low until they have been tried in different places, under varying amounts of sun and shade for several years. Remember if they are introduced by a reliable breeder they have done well for a number of persons and in different states and should do well for you.

SUN AND SHADE

A few plants like *Rosalind* and *Bagdad* have done better in part shade for me. Some like *Gold Dust* do equally well in full sun or up to two-thirds shade. *Patricia* disappointed me in half shade, when moved into the full sun I found it one of the best. My old Lemon Lily does not have more than 5% bloom in part shade, where *Gold Dust* thrives.

Often pink and red flowers hold their color better in part shade. I want only reds and pinks that do not fade like *Wekiwa*, *Fire Red*, *Matador*, *War Path*, *Helen Wheeler*, *Georgia*.

CULTIVATION

I have not cultivated my daylilies for years. They grow in scattered places where power cultivation is impracticable. I put a mulch of saw-

dust, weeds, leaves or wastes from the kitchen around them. This conserves the moisture in dry spells, prevents erosion and makes my clay black and porous with lots of earth worms.

I am careful not to work sawdust into the soil.

INCREASE

There is the widest variation in the rate of increase. *Duchess of Windsor* and *Sonny* multiply slowly, *Caballero* and *Mayor Starzynski* may make eight or more divisions at two years. Some like *Fulva*, *Rosalind*, *Handow*, *Chengtu*, *Rajah* spread by underground stems, others are always compact clumps. Some like *Circe* and *Soudan* have to be divided every four or five years to get handsome blooms, others appear not to mind crowding.

FERTILIZER

I have found it difficult to use fertilizer in sufficient moderation around young plants. A number of times I have burned them with excess fertilizer so their leaves would curl as in the driest spells. Then I have watered them freely to wash away some of the excess fertilizer and they have recovered. On the whole my young plants would have done as well without fertilizer. The trouble is not with the fertilizer, but with my use. It is hard for me to use a good thing sparingly. My established clumps are helped by fertilizer.

DISCARDING

This is a really tough part of growing daylilies. 90% at least are pretty and have good points, but all the varieties cannot be grown on a city lot, then too, I need some trees, shrubs and a few other flowers. I keep a record usually for at least three years after the plants are fair size of *foliage*, size, quality of bloom, season, shape, *afternoon fading*, general effect in the garden, cut-flower value, etc. Now when room is needed for new ones, I go over my list and part company with some of the least desirable—occasionally they were favorites of earlier years but now are surpassed by newer introductions. Sometimes they are plants that should never have been introduced.

INDIVIDUALITY

Daylilies are individual and should be handled as such to get the most out of them. Some are tall and vigorous, some small and slender. Blooms vary in color and season from May to September, time of opening, durability, size, shape, color pattern, odor—from fragrant to none, height of stalks, branching, etc. Some like *Tara* and *Vulcan* have buds on the bloom stems which develop leaves often six inches and miniature roots. If planted these aerial plantlets generally grow. They seldom bloom until two years old, but they are always identical with the parent plant.

Some try to have evergreen foliage. My *Chengtu* grew to a height of six inches last January, only to be killed back to the ground. Foliage

on others dies around September, some foliage gets spotted and unattractive about blooming season. I rate no plant A unless it has good foliage from spring to freezing and attractive blooms in the late afternoon. Most varieties form dense clumps. *Chengtu* has never made a dense clump for me. Most foliage is two to three feet high, one-half inch wide but *Mignon* has short narrow foliage more like grass. If you love your plants you will find lots of differences and almost personality in them.

This is just a personal note to friends, many of whom will differ with my judgment. It is not the work of an expert or a commercial grower.

DAYLILIES AND WARTIME NEGLECT

WYNDHAM HAYWARD, *Florida*

Five years of wartime difficulties in matters of labor and neglect, too little of one and too much of the other, paid off handsomely in many gardens in Florida and the lower South in the way of an acid test for various daylily varieties, demonstrating quite effectively just what varieties could or could not "stand the gaff."

In the writer's gardens at Winter Park, since 1941-42 there had been little opportunity for proper care and attention to be paid to the large commercial daylily planting. For three years, garden labor was absolutely unobtainable, and during four years the proprietor was engaged in other war-time work, and was unable to give the plants the cultivation, fertilization and weeding they should have had. Water was not an issue, as the planting is located on good high hammock type land, which is moist to moderation in all except extended dry spells. Watering is seldom a problem except for a few weeks after planting new stock.

In the winter of 1946-47, the writer was finally able to give the entire daylily patch a good weeding, the first in more than three years. It was interesting to observe the condition of the plants after their long neglect in thick weeds and grass. A few varieties were scarcely affected. Some had disappeared completely, and most of these will not be replaced, as "weak sisters." Important was the fact that most of the plants surviving in good shape were originations of Florida hybridizers, including varieties from the hand of Theodore L. Mead, Dr. Hamilton P. Traub and Ralph W. Wheeler.

During their long neglect, the plants had not shown any multiplication. Valuable varieties as *Duchess of Windsor* (Traub), *Ruby Supreme* (Wheeler), *Pink Charm* and *Starlight* (Nesmith), *Caballero*, *Vulcan* and *Princess* (Stout), came through their involuntary and regretful period of trial in reasonably good condition, but with the same number of divisions as was recorded for them in 1941-42. From this can be deduced the maxim that good attention is necessary to propagate Daylilies by natural division in the South.

Of Dr. Stout's varieties, *Soudan* came through in best condition,

and a long row of this bright golden yellow variety bloomed to perfection, as if it had never suffered the indignity of being covered with hay for so long, in the spring of 1947. *Patricia* and *Dauntless* survived but were not recovered sufficiently in 1947 to bloom well. *Bagdad*, *Rajah*, *Bijou*, *Chengtu*, *Linda*, *Circe*, *Serenade*, most of them deciduous, suffered severely, and were poor bloomers in 1947. Even *Mikado* failed to show vigor enough to survive in good shape, a long row being only about 25 per cent alive when uncovered.

But Wheeler's *Ruby Supreme*, Traub's *Duchess of Windsor*, Traub's *Indian Chief*, his *Happiness*, *Granada*, and others, Fisher's *Chisca*, another Southern daylily, and numerous varieties of the writer's origination came through their "ordeal by grass" in excellent shape, and it may be pointed out that most of these are evergreen in character more or less. Therefore it may be set down that maxim No. 2 gained from the experience is that evergreen varieties tend to survive under difficulties better in Florida and the lower South. This is nothing new, but was a prevailing belief which the results strongly supported.

On the other hand, there were a lesser number of deciduous varieties, including Leonian's *Cerberus*, his *Dr. Leon*, Mrs. Thos. Nesmith's *Pink Charm*, Dr. Stout's *Boutonniere*, his *Festival*, and *Hankow*, George Yeld's *Radiant*, and Amos Perry's *Margaret Perry*, which emerged from their long neglect in reasonably good shape. With a season's good care they should be back to normal again. Of the Sass varieties, *Moonbeam* and *Star of Gold* came through successfully, the latter blooming to perfection in the spring of 1947. Most of Amos Perry's creations, except *Mrs. Perry*, a large evergreen golden yellow, and *June Boissier*, another evergreen, passed out of the picture completely, and will not be restored at Lakemont Gardens. They are apparently not suited for long survival in this subtropical climate except under the best garden conditions, and those are what few gardeners can give their daylilies all the time in Florida,—the best conditions.

As for the Carl Betscher originations, some fared well, as *The Gem*, *Modesty*, *J. R. Mann*, *J. A. Crawford*, etc., but most of them were found not too vigorous for this kind of unavoidable test. *Ophir* (Farr) bloomed poorly in the spring of 1947. So did *Hyperion* (F. P. Mead). *H. fulva rosea* (*Rosalind*) was weakened by its long neglect, but survived in a few plants which bloomed scantily in 1947.

A patch of several hundred choice hybrid seedlings planted in 1941, when uncovered from their crop of grass and weeds, had shrunk to small size, but a number of them bloomed in 1947 to give a good idea of the quality of this planting, to the pleasant gratification of the writer, but probably 25 or 30 per cent of the seedlings were lost in the years of thick grass. Whatever has survived ought to be tough enough for ordinary garden purposes. They really had to take it.

Of the writer's own originations, which he has left for last and minor reference, the majority, all Florida grown seedlings and propagated in the Sunshine State, survived in good shape. Some displayed remarkable vigor considering the conditions which they had to endure.

Among those which bloomed well in 1947 were *Flamente*, *Emperor Jones*, *Nubiana*, *Mrs. H. H. Dewey*, *Othello*, *Marconi*, *Old Rose*, *Tahiti Belle*, *Rosita*, *Redman*, *Ginger*, *Cleo*, *Antares*, *Osceola*, *Sybil*, *Minnie*, etc. Their good showing is an encouragement to continue the effort to produce better things for Southern Gardens in the daylily line.

MY DAYLILY INTEREST

MRS. W. E. MACARTHUR, *Florida*

The interest in daylilies began for me in my grandmother's garden a great many years ago, so it was natural for me to plant *Hemerocallis fulva* and *Hemerocallis flava* in my own garden.

My first attempt at hybridizing daylilies had a tragic ending, because two little girls invaded my garden at dawn one May morning gathering the fine precious seeds filling their baskets and covering them with azalea blossoms, hurrying out into the garden seeking to solve this ritual, they ran scattering the immature seed pods and my daylily crosses were delayed a whole year, this defeatism evolved itself into a volcanic eruption of thoughts on children, animals and *Halictus reticulatus*.

My next attempt was a cross between *Hemerocallis fulva* and *Sovereign* which resulted in a lovely semi-dwarf bicolor that has been named *Harriet Trczyulny* for a deceased member of my Garden Club, as my daylilies come into bloom and are worthwhile in shape, size and color they are named for the members of my Garden Club. This new lily, all my own, inspired me to continue hybridizing *Hemerocallis*. I had used *Vulcan* as the darkest red until *Ruby Supreme* and *Theron* were acquired. Am anticipating many thrills when these seedlings come into bloom, my *Helen Carnell* is a cross between *Sir Michael Foster* and *Vulcan*, is a spectacular bicolor for me at least.

The peak of daylily bloom in Florida comes in May and June, of course there is a scattering bloom that is most welcome during the summer and fall months, Florida is never without some blooms from these prized perennials.

Mr. Wheeler's *Ruby Supreme* is a magnificent lily in color, shape and performance, however, it seems to produce infertile pollen, and the flowers fade under our blazing sun. It should be planted in semi-shade where it commands first attention. *Vulcan* holds its color in sunshine a little better, is an early bloomer, produces a fair percentage of seeds; both of these varieties are shy on proliferations.

Mr. Hayward's *Salmon Rose* is my best pink, some of my crosses show this strain decidedly, even a clearer pink but the shape of bloom is not so desirable. Mr. Sutton a local nurseryman has developed some outstanding new daylilies which are being recognized and sought after in Florida, one beautiful tall red bears the name of *Eleven Fifteen* because the lily closes at 11:15 P. M.

Dr. Traub's *Granada* is a wonderful lily, prolific bloomer on well branched scapes, holds its color, but does not increase fast enough to

meet demands. Dr. Stout's *Mikado* continues to be a very popular daylily, one of my crosses is almost an exact replica of this daylily, but I don't know what I used to make this cross; it's almost impossible for me to keep a correct record, to say nothing of handling the seedlings on a city lot.

There is nothing more attractive than a semi-circular bed, with a bird bath in the center, planted with a collection of daylilies in all the wonderful color combinations of gold, pale yellows, reds, purple and pinks that are available now, daylilies can be moved any time in Florida, however it seems wise to transplant soon after the blooming period to insure a good root growth during fall in readiness for spring bloom. The evergreen varieties are more satisfactory in Florida, although there are some choice varieties of the deciduous group that are very desirable.

Aurantiaca Major, *Ajax*, *Sir Michael Foster*, *Sonny*, *Nebraska*, *Hyperion*, *Dauntless*, *Patricia*, *Princess* are standbys for gold and pale yellows, while *Vulcan*, *Sachem*, *Theron*, *Ruby Supreme*, *Baronet*, *Cabellero*, *Granada*, *Hankow*, *Bertrand Farr*, *Red Bird*, *Port* and *Linda* serve as prized reds and bicolors for any garden, there are a great many beautiful new comers available now in the trade.

Daylilies and other flowers commercially grown are menaced by thrips, an infinitesimal insect that blights the fine texture of blooms, even so with the trials experienced, I like to go into the garden early in the morning and watch the lilies unfold, it restores the inner satisfaction of the unfailing, universal assurance of God's love and care for the whole system of created things.

NOTES ON DAYLILIES IN MARYLAND—1946 SEASON

J. S. COOLEY, *Maryland*

Daylilies in this locality normally begin blooming about the first of May, and the usual order of blooming is *Gold Dust*, *Minor*, *Apricot*, *Middendorffii*, *Sovereign*, and *Flava*. In 1946 however the order of blooming was *Sovereign* and *Flava* followed by the other early bloomers such as *Gold Dust* and *Minor*. The flowers on *Sovereign* and *Mrs. J. R. Mann* were very abnormal, they were very narrow and slender, and never opened to their normal width. The dividing line is not always sharp between the normal and the abnormal blossoms, but it would seem to be best to reckon as the time of blooming the time when normal flowers and normal scapes appear. *Apricot* usually has its flowers borne on scapes about two and one half feet tall. This year the scapes were only about six inches tall which meant that the flowers were almost completely hidden by the foliage. *H. Middendorffii*, which usually is not floriferous in this region, was much more profuse in its blooming than is normally the case. It was in full bloom early in May while *Gold Dust*, which is usually much earlier, did not bloom until May 10.

The character of the blooming of these early varieties is probably largely dependent upon the growing conditions of the previous season.

If more were known about the effects that the different weather conditions produce, the cause of the abnormal flowering noted above would doubtless be better understood.

The earliest varieties are often somewhat disappointing because of the sporadic and sparse blooming, but in the years when they bloom well they more than compensate for the poor seasons by their profusion of beautiful yellow flowers.

The varieties in the slightly later group, which we designate as early midseason, have been much more dependable year after year than the earliest ones. *Flava*, a member of this early midseason group, when planted near blue and purple iris makes an unforgettable garden picture.

In the early mid-season group are *Chrome Orange*, *Queen of May* and *Flava*. *Queen of May* and *Queen Mary* bloom for us at the same time. *Queen Mary* is the finer flower and thrives splendidly here, but it is said to be lacking in winter hardiness for northern regions. *Chrome Orange* also serves to bridge the gap between the early and the mid-season varieties and has a very definite place in the garden.

The mid-season varieties were very beautiful this year, especially, those varieties having a suffusion of red over the ground color. *Dr. Stout* and *Wau-Bun* are examples of this type of flower. The quality of the red color of many of the red varieties also was finer this year than usual. The weather was very dry before the mid-season varieties began blooming, but about the time they began to bloom the drought was broken and there was adequate moisture throughout the blooming period. The temperature was lower than usual, but apparently it was sufficient for the daylily flowers to develop the exceptional richness of color.

The color of daylilies this year had its interesting and also its puzzling aspects. The question of the influence of weather conditions on the development of the various colors and on the intensity and richness of color is a matter worthy of careful study. There is no doubt that the colors of the same varieties vary in quality in different localities. Among the important environmental factors that may affect the plant and its ability to develop one quality of color rather than another may be mentioned adequate soil moisture, excessive soil moisture, relative humidity of the air, soil and air temperature, and the interaction of a certain temperature in conjunction with dryness, and also with adequate and with too much moisture. It would be interesting if a number of growers would make observation on as many of these conditions as possible and report their findings.

The daylily is in general a warmth loving plant. Cool weather affects the development of certain colors in the flower much more than others. The red color develops very poorly in cool weather while the yellows are less affected. It often happens therefore that a variety having a heavy yellow undercolor will be a beautiful red one year and in another year it will have a decidedly brownish cast due to the unequal development of the red and yellow colors, different temperature conditions.

A word may be said here about the behavior of late varieties here where the weather may be unfavorable. Those late varieties blooming just after the midseason varieties are gone are good—such varieties as *Mrs. W. H. Wyman*, *Dorothy McDade*, *Aztec Gold*, *Berwyn*, *Hankow*. On the other hand those varieties having many of the multiflora characters such as *Autumn Prince* and *Boutonniere* have not proven very satisfactory as garden flowers in our grounds. There is urgent need of breeding work to produce some late varieties that will be first rate in spite of adverse weather conditions.

FLORIDA FIELD CULTURE OF HYBRID AMARYLLIS

J. D. DU PUIS, M.D., *Florida*

The following observations may be of some interest to growers of hybrid *Amaryllis* in open field culture, in “the Land of Palms and Sunshine.”

First let me state, that I have about three acres planted, in rows eighteen to twenty inches apart. The original bulbs were planted about fifteen to eighteen inches in the drill, and the greater number of the original bulbs have multiplied within the past eight years by offsets with a record of from one to twenty-five bulbs now in each hill of various sizes and ages. They are according to the Holy Scripture, fulfilling the law—“Multiply and Replenish the Earth.”

The past two years, due to war and post war conditions, many varieties of grass and weeds have given the hybrid *Amaryllis* a tough race, for one was unable to employ labor that would work on a farm. However, within the past 12 months, with a crew of men ranging in age from 65 to 75 years, I have been able for the first time in several years to have the weeds and grasses removed, and to have the hybrid *Amaryllis* fertilized and cultivated. To their credit it should be stated that these elderly men are doing a better job than the generation that is more robust physically.

The *Amaryllis* have shown their appreciation for the care and regular fertilization, in other words—they are growing rapidly and looking exceptionally well.

The regular blooming period of *Amaryllis* is February through May in this area, however, with the various ages of the bulbs I have beautiful blooms every month of the year. Cross pollination in open field culture in the way that nature does it, has produced a multiple creation of many different and wonderful color patterns, some of which are individually rare and beautiful. To attempt a detailed description in a general way of the color patterns that have been developed in my garden is not possible in the allotted space, and the only way to really appreciate this color panorama in the regular blooming season is to visit my garden while they are in their full glory. For illustration, a few are pure white, and many rare individuals are nearly pure white.

It might be well stated, that a walk through my *Amaryllis* garden, when in full bloom, gives me new inspiration to carry on and patiently listen to the aches and pains of many patients whom I have tried to relieve and assist nature in curing for the past 49 years of my practice as a Physician and Surgeon.

In further reference to the acreage and the multiplicity of bulbs that have been produced as offsets of the original bulbs in the past several years it would take many acres of space now to transplant the young bulbs that have been produced by the mother plants. However, believe-it-or-not, some of the rarer individuals are practically non-producers of offsets, or do so only in a very small way.

Within the past month I have treated some of the rarer bulbs according to the cuttage methods recommended by experienced horticulturists in an effort to speed up the vegetable reproductive process. However, it will be some time to determine the effectiveness of splitting the bulbs into several parts perpendicularly in this program to create more bulbs of the particular kind or individual.

I have experienced a ready market for blooming size bulbs, with repeat orders by wholesalers and individual purchasers, and also for cut flowers at Easter and Mother's Day, when they are received locally by flower lovers, particularly by the many thousands of winter tourists.

PROBLEMS OF FLORIDA AMARYLLIS CULTURE

WYNDHAM HAYWARD, *Florida*

Growing *Amaryllis* commercially in Florida is not something to start on the spur of the moment overnight, as the veteran growers will advise the newcomer. It is a serious business, requiring careful, conscientious attention to various details and major factors, and with many angles to be considered beyond a mere bulb garden's problems.

First one must decide what market one wishes to grow the bulbs for—the class of trade to which one will try to sell the bulbs when mature. The fancy bulb trade is a more highly specialized line, requiring expensive parent stock and more careful attention to cultural details, as these bulbs are always the more delicate.

Some grow their *Amaryllis* under partial shade, as a lath house, others in the open ground. This last requires a better grade of soil, preferably like the Conway type soils in Orange County, Florida, or any comparable medium type of sandy loam, with a good humus content, enough to give the soil a dark color. Good drainage is essential, and every care must be taken to select a site which will not be flooded in the case of an occasional hurricane or heavy spring rain. Flat woods type land, unless carefully ditched is usually too sour and too wet, or liable to become so. Florida's heavy hammock soils are ideal for *Amaryllis* if sufficiently well provided with humus. In small plantings this humus can be added to the soil in the form of manure, muck, peat, compost,

rotted leaves, etc., providing sufficient basic material is also added, as ground limestone, to keep the soil reaction near neutral.

It takes three years to grow the bulbs to blooming size from seed under good field conditions. The first year the bulbs are grown in a special seedbed, sometimes in half shade, as a lathhouse. The plantings must be kept clean of weeds. Weeds rob the bulbs of moisture and fertilizer and crowd them in the planting so that they do not make their normal growth. Failure to weed a planting when necessary and continued neglect for a few weeks may retard a planting for a year in growth. Absolutely clean cultivation or a mulch is the best that can be done for the bulbs. A light dressing of fertilizer three or four times a year, between the rows, any good commercial vegetable fertilizer with adequate potash, is about all the attention that is required besides weeding.

Florida, with some 50 inches of rainfall annually, on the average, usually provides enough water for the commercial bulb plantings without irrigation, especially as the bulbs make most of their growth in the summer when the State has its "rainy season". However, there are occasional dry springs and falls, when growth may be seriously retarded by lack of rain, and hence if provision for irrigation can be made it will pay off in the end with larger crops of bigger bulbs in shorter time.

Insect pests under field conditions are few, the worst of them being an occasional caterpillar and the large "Lubber Grasshoppers", a pest native to Florida and difficult to control without continuous vigilance. The grasshoppers hatch in the spring from eggs laid the previous year. At first they are black and red, and about an inch long. They are attracted to anything of the *Amaryllis* nature like some impelling biological urge. A half grown Lubber Grasshopper can eat the leaves off a large *Amaryllis* bulb or devour a small *Amaryllis* bulb down to the roots (and frequently does) in an afternoon, with hardly any effect on the beast's appetite. And it can go on for days and days at the same capacity. In mid-summer the Lubber Grasshoppers mature into the adult form, yellow and green tones, and their *Amaryllis* eating capacity increases. At this stage they may be three or four inches long, and the damage they can do to a choice planting of the bulbs is appalling!

Strong sprays of such powerful insecticides as 5% DDT make them only slightly ill. Poisonous sprays, as arsenic, will control them, but it is difficult to keep the leaves uniformly covered with the poison. The best control is established by a daily patrol through the *Amaryllis* planting, preferably in the early morning, before the hoppers have begun to scatter. At night the young hoppers congregate on the upper parts of the leaves, and may be picked off by hand readily into a can of kerosene. After several weeks, their numbers will be decreased by this procedure, but it seems impossible ever to rid a planting of them entirely, as new ones are continuously flocking to the bulbs from outside, where they are a common pest of garden and field in peninsular Florida. Continued surveillance as described above, will maintain an adequate control of the hoppers in a commercial planting, but a few days neglect will cause a

rapid increase in the numbers of the pests invading the planting, and this will result in badly eaten foliage and damaged bulbs. A bulb with its leaves eaten all or partly away may miss most of its year's growth.

The seeds may be planted in flats of good garden soil, sweetened with wood ashes or ground limestone, the black, papery wafer-like things (seeds) being set thickly upright in slots in the ground or flat in little furrows. Not more than a quarter of an inch of soil should be placed over the seed. In a few days to several weeks, the seedlings will be sprouting. Freshly sown seed is better in germination, as the seeds lose viability fast after a few weeks.

Good drainage is necessary in the flats, and ground beds, three or four feet wide, may also be used in a lath house where watering facilities are available. The seed should be watered cautiously and carefully until well sprouted, and not over-watered at any stage of growth. Soggy, wet soil will cause rot and decay of the bulblets. A light dressing of commercial fertilizer may be mixed with the soil at planting, along with the sweetening material, if this last is necessary. Well rotted compost or rotted manure should be added if the soil is thin.

At one year, the bulbs should be one half to an inch in diameter with good culture. They are then large enough to be set out in the field, preferably when the soil is moist and cool, certainly not when the weather is hot and dry, unless irrigation is available.

Cold weather, such as is experienced in Central Florida, is not dangerous to the life of the bulbs, although freezing temperatures will cut down the leaves, which are tender, the bulbs or their necks may be frozen if exposed above ground. *Amaryllis* bulbs in pots are especially subject to damage in Florida if the temperatures go down to 20° F. or less, as happened on several nights in February and March 1947. Bulbs in pots on the writer's place at Winter Park went through temperatures down to 25 degrees or slightly less, lasting several hours. Some damage was noted in the case of most of the bulbs in pots, and blooming was retarded in date, and the quality of the flowers was severely affected.

Flowers of these bulbs which had been exposed to the cold weather in pots were distorted in some cases, the flower stems were weak, and several bulbs were killed outright, including a number of small hybrid *Amaryllis* in four inch pots. Bulbs in the open ground lost their leaves but were otherwise unharmed, as the cold was only sufficient to cause a light frozen crust to form on the surface of the ground where moist. Newly potted bulbs were more seriously injured than others, the frozen upper tissues of the bulbs eventually showing decay, which spread down into the basal portions so that the bud or growing point died. In a few such cases, after several weeks, small bulblets began to form on the outer ring of the basal tissue, although the core of the old bulb was dead.

Several dozen newly potted bulbs, imported from Holland, were given emergency shelter in a spare room of the writer's residence, where the temperatures went down to 35 and 40 degrees for several hours, and these bulbs, being mostly of naturally weaker greenhouse constitution, showed some of the same symptoms of cold damage, but to a lesser extent, when they finally came into flower.

AMARYLLIDS IN THE NORTHWEST

HARRY L. STINSON, *Washington*

One day in early spring when the poet Wadsworth was strolling along the shores of Lake Windermere, the sight of several hundred daffodils "dancing in the breeze" so thrilled him that he sat down and wrote one of our immortal sonnets to their golden beauty. I have often wondered what he would have written if he could have seen one of our present day daffodil farms in full bloom. A January issue of the Life Magazine shows a view of 6,000,000 bulbs blooming in one of Mr. Jan de Graaff's fields with the snow capped Mt. Hood towering in the distance—what a sight of waving golden blossoms. Not too many years ago I remember one of our leading Eastern bulb dealers making the statement that he was skeptical about the forcing quality of the western bulbs. Since that time the production of excellent quality bulbs has become an industry of major importance in several localities of Washington and Oregon. Annually over forty carloads of bulbs are shipped to the Eastern markets from the fertile fields of the Northwest. To this can be added the rapidly developing industry of growing Easter (Croft) Lily bulbs, which has been steadily increasing since the supply has been curtailed by war.

While the climate of the Northwest is ideal for the culture of those bulbs which require a long cool, moist growing season before the rigors of winter really set in, it is not too hospitable and leaves much to be desired by those who would grow the more tender and warmth loving amaryllids. Their natural habitat is usually a long and warm growing season which we cannot give them except by artificial means, and that experience has shown many of them do not like. Our growing season normally is about 120 days and the nights are so cool that we can grow only the short season crops on the west side of the Cascade Mountains. For several years I have unsuccessfully been trying to grow the beautiful *Hymenocallis (Ismene) calathina*. The bulbs bloom splendidly the first year but they are still green and immature when they are cut down by frost and have to be dug for storage. In fact they are so immature that many do not survive the period of dormancy. Another year I am going to start them in pots and transfer them later to the garden by burying the pots in the ground and then move them back under glass before the first killing frost. Possibly in this way I can enjoy their beauty year after year. Some of the other *Hymenocallis* do well under glass the year around.

California is not so far away but what many of our friends and neighbors sojourn within its borders. While there they see the exotic Painted Lady, *Brunsvigia rosea* (Lamarck) Hannibal (syn.—*Callicore rosea* Link; *Amaryllis belladonna* Ait., non Linn.) and bring back a few bulbs of it for their gardens, only to be disappointed for it seldom blooms under our natural conditions. "Why does my *Amaryllis* not bloom?" is one of the most frequently asked questions that we have to answer among our gardening friends. Usually they have a situation to which they can move it where it will be more sheltered and protected

against frost, and they are happy again for it blooms. Unfortunately some of our chain stores of the dime variety have been offering these bulbs for sale pictured as hybrids of the true *Amaryllis belladonna* Linn. [(non Ait.), syn. *Hippeastrum* Herb.] This sort of misrepresentation is unfortunate, but can be corrected in time by education of the public through the garden clubs.

Very infrequently a clump of crinums is to be seen in one of our more extensively planted gardens. *Crinum Powellii* and its parent *Crinum bulbispermum* (syn. *C. longifolium*) have proven to be perfectly hardy here at Seattle and could be more generally planted as it gives us liliun-like flowers later in the season when such flowers are rather scarce. Its other parent *C. Moorei* is not quite so robust and will not survive our winters very long without some protection. Several other crinums I grow under the shelter of a cool greenhouse and they reward me each year with their gorgeous blossoms.

Probably I have been negligent of my trust for I have not been pushing the *Hemerocallis* program as diligently as I should have. The West lags far behind the East in the introduction of the newer hybrids, however they are beginning to be seen in ever increasing numbers. The old types are found in nearly every garden and no doubt these new hybrids will win favor by their gorgeous colors and counterbalance the fact of their ephemeral qualities. They bloom at a time when there is a scarcity of color in the garden and will help to fill the gap between the perennials and the colorful annuals.

In my rather limited expanse of glass I have several other members of the *Amaryllidaceae* growing, such as, *Vallota*, *Sprekelia*, *Clivia*, *Amarcrinum*, *Nerine*, and *Lycoris* which did not take too kindly to living under glass so I moved it outside against a south wall. It may bloom. During the war when fuel was at a premium I lost quite a few of my amaryllids due to cold and dampness.

Sooner or later around this household the conversation always turns to the alstroemerias and bromareas. Year by year they are gaining favor in the eyes of the gardening public. Their ease of culture and wide range of colors makes them a favorite of every one who grows them. *Alstroemeria pelegrina alba*, according to the reports from Mr. Hinman, of Geneva, Illinois is increasingly demanded by the florists of Chicago. The *A. chilensis* are lagging behind slightly as they are a little more difficult for florist's use, but as they learn of their excellent keeping qualities I have no doubt but that they will be more acceptable to the trade. Last year we shipped the cut flowers by air-express and air-freight to Mr. Hinman and learned many things about their behavior in transit. This season I sent a small package to Mr. Foster, and after a delay in transit he kept them about a week. If and when we can get better and more reliable airplane connection at terminals I believe it will be possible to ship them to any place in the United States. After considerable experimenting with *A. violacea* and losing several hundred tubers I have been rewarded with the most wonderful display of violet or lavender you could possibly desire this side of the rainbow. *A. nemorosa* has proven to be evergreen and almost everblooming. It sets seeds

very readily when grown adjacent to *A. psittacina*, (syn. *A. pulchella* of the trade, which it is not). *A. Ligtu*, Feuillet has proven so far to be as hardy as the *A. chilensis* hybrids and was a gorgeous sight this year with its pink blossoms with white on the two upper petals. In growth, it



Fig. 185. *Hymenocallis caribaea*. Photo by W. M. James.

differs considerably from *A. chilensis* and all doubt is removed but that it is really the one which Father Feuillet found and described. Mr. Foster informs me that his *A. caryophyllaea* is finding Florida to be a very hospitable home and is increasing rapidly. He has hopes of offering it to the trade within a couple years. My few plants are doing as well as could be expected under their growing conditions. I hope to see bloom this fall. Dr. Bullock was extremely kind to bring specimens of the alstroemerias indigenous to his vicinity in Chile when he came to the

States on a much needed furlough. Among these specimens I believe he has another species which we do not have in cultivation, at least it is new to me,—not too surprising. Dr. Bullock reports that out of the thousands of capsules he had examined in Chile he found no seeds. A worm had beaten him to them and had eaten them. I would recommend that some system of rationing be instituted at once so that we might receive our rightful share of the seeds for our gardens.

Hermano Daniel has been a most faithful friend in securing seeds of the bomareas from the Cauca River region in Colombia. If my collection of bomareas increases much more I will have to enlarge my cold-frame area to accommodate them. Rev. H. Daniel is compiling a treatise on the Botany and Geology of Colombia and had hopes of doing some research at the Smithsonian Institution, but his plans could not be realized at this time.

[AMARYLLIDS NORTHWEST—Continued on page 118.]

DIMINUTIVE AMARYLLIDS

WYNDHAM HAYWARD, *Florida*

Just as some Alpine specialist cherishes his rare *Meconopsis* plants from beyond the mighty Himalayas, or an expert pomologist rubs his hands at sight of a collection of choice new hybrid apricots,—so do I enjoy my dainty little bulb-flowers of *Zephyranthes*, *Cooperia* and *Habranthus*; wait on them patiently, faithfully until rewarded by a flush of colorful bloom, or perhaps only a flower or two of a particularly scarce type.

They are lovely things, wanting as a rule little in care and attention, save only the simple conditions which suit their needs, in most cases. Others are more fleeting, refuse to stay long with me, and finally disappear completely from my flats and pots. These are the wayward children of the group, which possibly require more lime in their soil than I dare to give them, or like less water than our Florida summers provide. (We had at least 12 inches of rain this June of 1947 at Winter Park, Fla.)

My first and still favorite love among the little bulbs of the *Amaryllis* family in this group is the familiar large-flowered (for a *Zephyranthes*) *Z. grandiflora*, formerly called *Z. carinata*. It is a lush, easy-growing thing, which never or very seldom seeds. A few correspondents claim to have seen it produce seeds. The flower is a rich rosy-pink, luscious as a bowl of raspberry sherbet. The bulbs seldom reach more than an inch and a quarter in diameter, and may bloom five or six times a season, after every good summer rain.

Z. grandiflora is common all through the South and Midwest, being found in washtubs in yards, and in beds in gardens, planted in cemeteries, in window boxes, porch boxes, urns, pots, and everywhere else. It multiplies fairly rapidly by offsets, so that a few bulbs will

make dozens in a few years. The foliage is rich green and 6 to 12 inches long, linear, up to a quarter of an inch broad.

It is reliably reported as native to Central America and the West Indies. In parts of the South it has naturalized itself, and may be found blooming in long-abandoned plantation and country gardens. It is perhaps the most vigorous and free blooming of all the *Zephyranthes*.

Next I would place *Zephyranthes rosea* and *citrina*, two of the most beautiful of small flowered bulbs in all the plant world. *Z. rosea* is reported from the Cuban mountains, and has tiny linear, bright green leaves, glossy and beautiful, and charming rose-pink flowers about an inch to an inch and a half across in late summer, and sporadically before. When a patch of this bulb blooms in unison, as they do when well established, it is a sensational effect, indeed, one of the big moments in floriculture. The actual bulbs are up to $\frac{3}{4}$ of an inch in diameter, mostly smaller. It does well in pots, but is not as hardy as *Z. grandiflora*, which can stand lower temperatures. They are tropical bulbs and should never be exposed to freezing in the ground.

Gorgeous *Z. citrina*, is the best yellow type commonly in cultivation in the United States. And I don't mean commonly, as it is quite rare in fact, but found now and again in choice collections. The bulbs have narrow, bright green leaves up to a foot long, and make bulbs up to an inch in diameter. It is said to be a native of British Guiana. The flowers are light golden yellow, and an inch or more in diameter, borne mostly in late summer on 6 to 8 inch stems.

Maybe I should like *Z. atamasco* best of all, as it is the type species of the genus, the one most widely dispersed in nature in the United States, (from Virginia to Florida and Mississippi) and made famous nearly 150 years ago by Redouté, Josephine's famous flower painter, in his *Liliacées* (Plate 31, which I am happy to possess.) But *Z. Atamasco* is not native down into Central Florida, and while bulbs of this beautiful native wild flower have survived with me for a decade, a few of them blooming famously every spring, they flower only once or twice and lose their foliage all summer long while the other *Zephyranthes* are in handsome appearance. They bloom first of all the genus with me in Central Florida, some of my flowers being four inches across, undoubtedly the largest of the genus, despite the name of *Z. grandiflora*. The bloom is simply huge for the size of the bulb in the case of a strain I obtained from the countryside near Tallahassee, Fla., and named *Z. atamasco* var. *major*. A pan of these would be the sensation of any British or American flower show in the spring. The bulbs are scarcely half an inch in diameter.

Z. atamasco is temperamental with me in pots. Even in the ground I have lost hundreds of bulbs obtained from as far north as the Carolinas, after a few years. The Tallahassee stock survives in healthy condition, in a light sandy loam in my lath house. It puts up flat green leaves something like *Z. grandiflora* in winter and blooms in March or April, or even before. Then the leaves vanish until the next winter. The pure white flowers of my Tallahassee strain are twice as large as

Redoute's specimen, which is painted apparently life size. They are pure white inside, four inches across on stalks 6 to 10 in. tall, with pink tinting on the outside as they fade.

Z. atamasco sets seed readily, but the seedlings are slow and difficult to raise because of their deciduous character. *Z. rosea* sets seed occasionally, and scantily, while *Z. citrina* sets seed readily and abundantly.

Z. candida and its variety *major* are almost too well known to mention. They are not happy in Florida unless given constant care, and I have never seen them naturalize successfully for any number of years, but understand that they do this readily in other parts of the South. The foliage is bright green and roundish, with flower stems up to 1 ft., and flowers pure white or pinkish-tinted on the outside. It is said to seed well at some places, but does not do this in Florida. It is the flower which caused the naming of the Estuary at Buenos Aires as Rio de la Plata (river of silver) because of masses of the flowers on the shore seen by the early explorers, so tradition has the story. The bulbs are half hardy, but should be protected from frost. The range up to $\frac{3}{4}$ to 1 inch in diameter. The flowers have pointed petals forming a white star 2 inches or more across.

My favored white species is the new *Z. insularum* found by Dr. H. H. Hume in Key West, and named accordingly, but probably not native there. It blooms freely in early summer, with showy porcelain-white flowers which are pinkish without and blunt tipped. *Z. tubispatha* is an old species from the West Indies, similar as to foliage, but with sharply pointed petals and pure white on the outside of the expanded flower. *Z. tubispatha* is more delicately constitutional, and more disinclined to give fine shows or bloom. *Z. insularum* will not seed with me, and *Z. tubispatha* rarely sets seed.

Z. Treatiae and *Z. Simpsoni* are distinct native Florida species, having roundish foliage, which is glaucous in *Treatiae*, white flowers like the common type of *Z. atamasco* in the case of *Z. Treatiae*, and long trumpets with an extended green base and very slight flare at the top in *Z. Simpsoni*. They grow well in sandy soil with me, but are sparse bloomers, seed fairly well, but grow slowly and with difficulty in flats. Good drainage seems to be one of the main factors for *Zephyranthes* in cultivation, even though some kinds are found in more or less swampy spots in nature. (*Z. atamasco* and *Z. Treatiae*).

Most of these *Zephyranthes* like a loose, friable, fertile soil, in the garden or in pots, pans or boxes. They like considerable humus or well rotted cow manure in the soil, (25 per cent) if sandy loam is used. Good drainage is essential, as in cultivation they will soon rot off their roots and waste away if subjected to standing water or soggy ground.

Seedlings may be grown in a flat or pan of the same soil, out of the reach of heavy drip or rain, and kept weeded and clear of slugs or grasshoppers which are their greatest pests in Florida. Otherwise they have no known enemies except an occasional caterpillar.

One of the greatest opportunities for botanists and horticulturists

exists in the Latin American countries in the collection of new species of *Zephyranthes*, *Cooperias* and *Habranthus*, not to speak of small-flowered types of *Amaryllis* and other similar subjects. Scattered through Mexico, Peru, Argentina, Chile, Brazil and other countries South of the Border are many species reported in the literature, perhaps once known to horticulture, but now lost or never in cultivation at all. There is *Z. andicola* with violet flowers in Chile; *Z. coerulea* in Argentina, *Z. longipes* in Uruguay, *Z. Lindleyana* and *Z. verecunda* in Mexico, and many others. Probably there are new species still to be discovered.

The genus is becoming more popular. Garden lovers are turning to their culture gradually, and cherishing these choice beauties as they deserve. In a few years they will be better known. They are fascinating in their way as the *Crocus* or Tulip species and similar small bulb favorites.

Of the Texas species of *Zephyranthes*, I have recently flowered *Z. longiflora* for the second time from bulbs received from Miss Willie May Kell of Wichita Falls, who stated they were collected in the Davis mountains. It is a lovely lemon-yellow thing, with fine, chive-like leaves a foot long and more, very slender. There are other yellows in Texas, *Z. pulchella*, and one or two more uncertain as to identity. Texas also boasts the beautiful night-flowering *Cooperia pedunculata*, *C. Drummondii*, *C. Smallii* and *C. Traubii*. The first named *Cooperia* is one of my favorites, and makes large bulbs up to 2½ inches in diameter, but usually an inch and a half to two. The flowers are flat and spreading on a 10 inch or more peduncle. The leaves are flat and grayish green to blue, and tend to die off in the summer. The leaves of *C. Drummondii* are more roundish and the flower, which has a long, slender tube, is half the size of *C. pedunculata*. Both are more or less fleeting. They open in the early evening, and are more or less wilted by the next mid-morning.

One of the choicest of these small bulbs of the *Amaryllidaceae* is *Cooperia Smallii*, which bloomed for me last week (late June 1947) after five years of idleness in this regard. It is a showy little sulphur-yellow flower from down in the lower Rio Grande Valley, in Texas, the only yellow-flowered species of *Cooperia* known, and a recent botanic discovery, comparatively. It was named for the late Dr. John K. Small, long the New York Botanical Garden authority on the flora of the Southeast. Possibly my bulb, which survived in the ground in my lath shed during the war years under bad neglect, but did not bloom as I remember since 1942, is among the few bulbs of this lovely species in cultivation in the world today. It has never been offered in the trade. I am nursing the bulb in its new pot with care to set seed, and hope to grow more *C. Smallii* bulbs from that.

In what other branch of the field of ornamental horticulture can one have the thrill so easily as with these dainty bulbs, of knowing that the bulb you possess is one of the rare but choice beauties of the plant world, and that perhaps no other person on the entire earth has one of the

same species as you in bloom or even in cultivation. However, that is no situation to appeal to the miserly instinct, which possesses some plant fanciers, as there is no meaner stripe in any soul than the queer quirk of mind of some horticulturists and persons who call themselves garden lovers, and who guard a new plant or bulb jealously like Midas his gold, withholding it from all private and commercial distribution until they have built up a stock of it or used it to their own full satisfaction in breeding experiments, before turning it loose to an awaiting gardening public. The riches and beauties of the world of plants belong to all, to all those who appreciate them, and no one has the right to "corner" some little item for his own pet, peevish pride and avarice. Especially when the new plant or bulb is purely the bounty of Dame Nature.

Texas, to return to our muttons, has also the pretty little copper-colored *Habranthus Andersoni* var. *texanus*, formerly called *Z. texana*. It is a tiny thing, widely found over the Lone Star State, and at one time thought to be the same as a parallel species *H. Andersoni* in Argentina, and possibly introduced from there. But its widespread existence in nature in Texas seems to preclude this possibility. It has slender gray-green foliage, and flowers an inch long on stems to 6 or 8 inches tall.

H. Andersoni var. *texanus* does not thrive in Florida soil. Probably it wants more lime or clay than we have in the Peninsular State. The flower is light golden yellow inside and copper tinted without. It seeds readily.

In South America there are at least two little known *Cooperias*, one in Brazil *Cooperia brasiliensis* recently discovered by M. B. Foster and the other *C. albicans* in Peru. Neither are in popular cultivation so far as known. There are a number of interesting *Habranthus* species, as defined by J. R. Sealy of Kew in the RHS Journal, Vol. XLII, Part 5, 1937, of which *H. robustus* and *H. brachyandrus* and *H. cardinalis*, (*Z. bifolia*) are best known in the United States. *H. robustus* should be grown by the dozens in every Southern garden, for its showy white and orchid-pink trumpets which are on stems up to one foot tall. The foliage is a light gray green and the bulbs black, up to 1 and $\frac{3}{4}$ inches diameter. In the case of *H. brachyandrus* the pink is a purple rose and deeper color pervades the flower. It is less free flowering with me, but Frank Vasku of Winter Park, who also grows many of these things, finds differently in his location. He grows them in ground beds while I have them in pots and flats.

Some few of the *Amaryllis* (*Hippeastrums*) species are small enough to group with the bulbs previously mentioned, especially those in Chile, as *A. advena* and *A. miniata*. There are other small-flowered types, which deserve careful study and introduction into cultivation. Very few of these are known to bulb fanciers today.

Sealy in 1937 listed more than 35 species of *Zephyranthes*; some five species of *Pyrolirion*, a genus of related bulbs from Peru and Bolivia unknown to cultivation in the United States with rare exceptions; at least 10 species of *Habranthus*, and many species of *Amaryllis*,

25 or more from Chile, which may be of the intriguing small-flowered type. There is room for plenty of plant exploring here to introduce new bulbs for American gardens.

Amaryllis advena is an attractive red-flowered miniature type of *Amaryllis* from Chile, and yet suited to gardens in the lower South and Southwest. It is reported hardy well up toward the northern states in protected locations. It makes its leaves in winter, and blooms in mid to late summer, with good umbels (five or six flowers or more) on slender stems up to a foot and a half tall. The leaves are concave and glossy rich green. There is a pink type from Chile which may be *A. roseus*, also found in Texas and Florida gardens, apparently perfectly acclimatized. This is a vigorous gem well worth trying in suitable areas.

Habranthus cardinalis, described as the old *A. bifolia* by Dr. H. H. Hume, is perhaps the most colorful of the genus, with salmon-red blooms, varying in shade, found native in the Dominican Republic. It has slightly nodding, graceful flowers, of a most delectable tint, and grows well also in the coral soil of the Bahamas, but wastes away in a few years in Florida, possibly because of lack of lime in our Central Florida earth. It is just too, too divine, as the debutantes say, and truly makes the garden lover humble with its sheer beauty.

The writer would like to hear from bulb fans near and far who have species of these small bulbs different from any described in this article. There are probably some new or different ones in American gardens somewhere. The writer cannot close without a mention of the remarkable series of hybrids between *Cooperia* and *Zephyranthes* species introduced in India many years ago by Sydney Percy-Lancaster, who created the numerous hybrids which were introduced into the United States 10 years ago by the American Amaryllis Society and distributed thereafter to various bulb growers. These bulbs seed readily, and the writer has a number of descendants of the Percy-Lancaster *Cooperanthes* blooming every summer in his lath house. Mr. Percy-Lancaster followed his father's purpose of creating vari-colored *Cooperia* type flowers which would open in the afternoon like the *Zephyranthes*. He described them in *Herbertia*, Vol. 3, (1936).

ZEPHYRANTHES ROSEA AND HYBRID AMARYLLIS

FRANK VASKU, *Florida*

Last fall we received an inquiry from a large western wholesale bulb company about *Zephyranthes rosea*. Could we supply several thousand bulbs and could they be handled dry and sold over the counter same as *Amaryllis* bulbs? In Florida we leave them in the ground the year around and dig them only when too crowded or for sale, so the thought was new to the writer. I replied that I saw no reason why they could not be so handled. Since they ordinarily bloom in August through September it seemed best to give them three months of rest to

recuperate so they could stand that treatment. Accordingly they were dug in January and dried.

As there was no place ready nor time to plant them, the bulbs left over were put into a shed. The last week in May they were planted. The first week in June they were up and striving mightily to make up for lost time. It would appear therefore that they may be handled the same as other bulbs that are being sold over the counter in the stores. Since these little bulbs can take much punishment it would seem that they would make good subjects for rock gardens, edgings, window boxes and pots. They probably would not survive a freeze, however.

It is well not to be dogmatic. The above was written June 17. Two days later there were bulbs of *Z. rosea* blooming in the undug portion of the bed. Why they should be about two months earlier this year than other years, the writer does not know. Neither can he explain why after blooming thousands of *Zephyranthes grandiflora* through the years with never a single seed pod he should find one this year.

Has anyone ever found out why *Amaryllis* lose their roots and decline? If so, there may be preventive measures also, but that knowledge has not reached all *Amaryllis* growers as yet. Every year we lose many valuable bulbs. While absolutely rootless, these bulbs often put out leaves and even flower, but each year grow smaller, and if left to themselves, ultimately die. I found such a flowering one this spring. When through blooming the bulb was taken up, cleaned, rootoned and set into a pot of prepared soil. In two weeks it had started new roots and is doing well at this time.

This led to an experiment. To some soil of compost and rotten cow manure was added some superphosphate and bonemeal. Into this soil eleven rootless bulbs, scraped clean with the trowel of all dead tissue, were set and watered. Three days later most of them had started new roots.

Then the experiment was carried into the field. The rootless bulbs were lifted, scraped and put back in the same place from which they had been taken. Examined ten days later, one sixth of them had started roots. It would seem, therefore, that for whatever reason the bulb loses its roots, the dead tissue acts as an insulator for the bulb and tends to prevent its sending out new roots. It would seem further that when certain elements are brought into contact with the bulb's live tissue, its root forming ability is stimulated to put out new roots. The field trials should have been carried still further and rootone or superphosphate and bonemeal should have been tried as in the case of those eleven mentioned above but lack of time prevented this.

The writer realizes that these tests are inconclusive. We should try to find the cause if possible and adopt preventive measures if such can be found. In the absence of knowing the cause or causes, any knowledge of measures that help restore the vitality of the bulbs would be welcome.

STERNBERGIA, A REAL GARDEN GEM

J. S. COOLEY, *Maryland*

A very interesting plant belonging to the *Amarilidaceae* is *Sternbergia*. When visiting my old home "Rockville" in the Shenandoah Valley of Virginia some years ago the *Sternbergia* plants were in full bloom and quite beautiful. This planting has persisted there since my grandparents or maybe great grandparents planted it years ago. There is a tradition (Moncure, R. C., Nat. Hort. Mag. 21:106, 108. 1942) that *Sternbergia* bulbs were planted about the Governor's Place in Williamsburg and from there were distributed to the Colonial gardens. Some friends of the governor may have seen this striking and beautiful flower at the Palace and requested plants. After there was sufficient increase the recipient gave it to his friends and they in turn to theirs. In those days there was considerable exchanging of plants, that being a safeguard against losing the stock of some rare or highly prized plant. A plant that has persisted so well might easily have passed from one flower lover to another until it was quite widely distributed. This flower was apparently planted and used more extensively in Colonial gardens than at present. However it is adequately able to compete with the best of the present day flowers.

This genus has its origin in the Mediterranean region of Asia Minor and Europe. There are about a dozen known species. The genus is named for Casper Sternberg, a botanist and writer of Prague, Bohemia. The usual growth habit of the group is for the plants to send up strap-shaped leaves at the time of blooming in early fall. The leaves remain green all winter and die down in the latter part of May—before the *Narcissus* leaves die down. There however, is a species, *S. Fischeriana*, native to the Caucasus, that blooms in the spring. Although the species *S. colchiflora* blooms in the fall, its leaves do not appear until spring.

The usual species of the colonial gardens as well as the one grown at the present time is *Sternbergia lutea*. It is widely distributed in the Mediterranean region, extending to Persia. Its flower scapes are short at first but those of the later flowers may be as long as 5 or 6 inches. The waxy flower, which is somewhat smaller than that of the spring crocus, is a beautiful clear golden daffodil yellow—A very fine color quality. The flower although small and short is very appealing. When taking flowers to a nearby military hospital it was interesting to note how many patients when given a choice of an arrangement of *Picardy* glads or one of *Sternbergia* would choose the little *Sternbergia* in preference to the large and showy glads. For an intimate flower arrangement they are long lived and very satisfactory. Also the effect in the intimate garden is splendid. The plant however is small and must of necessity be used where large plants do not compete. The intimate garden or the rock garden is a good place for it.

The species, *Sternbergia macrantha*, native to Asia Minor, Syria,

Palestine and western Persia, blooms later than *S. lutea*, and has bright canary yellow flowers. It should be an excellent addition.

If one wants the ground of the *Sternbergia* bed covered all summer with green it is sometimes difficult to find a plant to meet this need during the months of June, July and part of August while the *Sternbergia* tops are dead. Perhaps one should be satisfied without a green plant in the *Sternbergia* bed for a part of the summer in payment for the autumn show.

There are many qualities to commend *Sternbergia lutea* as a garden flower. It has been perfectly hardy in this latitude during my 10 years experience with it. Furthermore, mice which destroy bulbs such as crocus *Iris reticulata*, *Chionodoxa*, *Brodiaea uniflora* and tulips, do not touch this bulb. Increase is fairly rapid. A few plants will soon multiply enough to enable one to have the mass necessary for the best garden effect.

Several common names have been applied to this flower. In some of the English publications it is called "Winter Daffodil," in others it is called "Yellow Star Flower." The common name often used is "Fall Crocus," but since it is not a *Crocus* that name is likely to lead to confusion. It seems unfortunate that we do not have an appropriate and easy common name to apply to this beautiful group of plants. It may be that some one can suggest a good common name.

The culture is not exacting. Dig the bulbs when dormant after the tops die down in June, and transplant at once or at least by August. Plant 3 to 6 inches deep. Best results will be obtained by planting in a rich loamy soil somewhat on the heavy side. They will thrive however in a wide variety of soils. The plant is said to be hardy as far north as Philadelphia and it has been reported as growing in sheltered locations in New Jersey and New York. This plant has thrived well and has been very satisfactory here in Maryland. It seems strange that so few gardeners use it. It may be that the reason is that few gardeners know its merits.

ALLIUM NOTES

WILLIAM LANIER HUNT, *North Carolina*

These *Allium* notes from a traveling gardener's note book are offered to the members in connection with the search for the most outstanding alliums. It is the writer's experience that one may belittle an undesirable species of *Allium* only to run into a most excellent species immediately after. In a genus with over 600 species, it is natural that a judicious selection is desirable from the standpoint of the ornamental garden.

R. H. S. GARDENS, WISLEY, 1945

Allium Macleanii?; this is the finest *Allium* that I have ever seen anywhere; color has amazing carrying quality; 3 ft. scapes; heads of bright blue-violet resemble *Agapanthus* flowers and may well be a substi-

tute for those who cannot cultivate agapanthus. Against the Administration Bldg.; in bloom late May; no foliage with blossoms; seed heads carried their color till August! [Seeds received from Wisley, Jan. 1946, planted June, and coming up in June 1946.]

Kew Gardens, 1945

Allium ampeloprasum var. *violaceum*, 2-inch, wavy wands, topped by purple-violet heads; graceful. In bloom July.

Allium Beesianum; a form with highly developed pappus that prevents their being very effective. Rock Garden; in bloom July 30th.

Allium carinatum, from Europe; very handsome, red-purple type, striking and worth while, showy; 12-15 inches tall. Mr. Scot in Rock Garden thinks it would be good in combination with *A. flavum*. [Mr. Scot is now with Ingwersen, 1946.]

Allium cernuum, from North America; the English have a wonderful form such as I have seen in the North Carolina mountains; illustrated in "Amateur Gardening", Sept. 11, 1945, p. 14, entitled "A Pretty Allium". Best *Allium* photo I have seen in English publications. In bloom June 11th.

Allium coeruleum, from Siberia; this must be an extra-flowering type; seed heads May 22; 3 ft. scapes; leaves dead, of course.

Allium flavum, from Europe. Same floppy old thing. In bloom, June 11th.

Allium cyaneum; grass-like foliage; many tiny blue flowers; Rock Garden July 30th.

Allium karataviense, from Turkestan; seed heads, May 22nd. Fine type here. [Editorial note: this needs an alkaline soil. Bulbs planted in pots rotted away in ordinary acid Maryland soil.]

Allium Margaritaceum; neat, floriferous, 10-inch scapes; in bloom, May 22nd; lavender.

Allium obliquum, from Siberia; greenish-yellow heads, 2½ to 3 inch scapes, May 22nd.

Allium ramosum; very fine, 18-inch scapes; flowers white with maroon marks; May 22nd; very floriferous. Is this a synonym?

Allium schoenoprasum var. *sibiricum*; large form of chives that is not as floppy as the type; June 11th; flowers deep violet.

Allium senescens var. *atro-violaceum*; pink-lavender; June 11th.

Allium senescens var. *glaucum*; almost pink; June 11th.

Allium sphaerocephalon L., from Europe and the orient; good shade of lavender; lies on the ground and flower heads turn up.

GARDIN BOTANIQUE DE L'ETAT, BRUSSELS, 1945.

Allium tuberosum, from Malabar; a good white, 12-inch *Allium*; check for synonymy with *Nothoscordum fragrans*; in bloom Sept. 2nd; garden effect is certainly the same.

Allium yunnanense; a tiny pink rock garden species; flowers have a pink stripe; July 30th.

Nothoscordum fragrans, "Amerique septentrionale"; beautiful bed of white alliums in effect. N. B. These bulbs evidently stay out of doors with no protection in winter.

AMARYLLIDS IN LOUISIANA

MRS. HERBERT V. KELLEY, *Louisiana*

Gardening in central Louisiana is subject to vagaries of weather over and above what one would expect from a perusal of the statistics covering mean temperatures. The average winter temperature is 56 degrees but a 30 degree drop in the course of a winter afternoon is not an unusual occurrence. Moreover, while the opening of December may be accompanied by harsh mid-winter weather, the early days of January may be balmy and spring-like. This latter period of equable temperatures is generally followed by what we of the deep south regard as extreme cold, sometimes as low as 30 degrees. Added to this are lengthy spring and fall droughts which coincide with the blooming periods of the spring and fall blooming species of the amaryllids.

Another important factor in outdoor bulb gardening is the abundant rainfall, some 65 inches for the area. The mercury hovers around the nineties for most of the long summer, which may be reckoned to extend from late May to late October. Since the rainfall is copious during this period it works a hardship on those amaryllids which become dormant in the summer and those which are in leaf are sometimes scalded by the alternating showers and hot summer sun.

Baton Rouge, in central Louisiana, is the beginning of the highlands and the soil varies from heavy clay to clay loam. Such a soil lends itself readily to the usual methods of soil improvement while retaining its beneficent moisture- and nutrient-retentive characteristics. While this type of soil is perhaps not regarded as the ideal medium for bulbs, it has been my experience that with little effort it can be made productive of spectacular success. It is slow to warm up in the spring yet highly retentive of the intense summer heat and it is to this factor that I attribute my failures with some of the amaryllids I have tried.

Notwithstanding these apparent obstacles to successful outdoor bulb culture, many of the amaryllids are grown successfully. Several do so well that they are thought by some to be natives of the section. The large pink *Zephyranthes grandiflora* which begins to bloom in late April and the white *Z. candida* which begins in early August, both of which are known locally as Rain Lilies because of their repeated bursts of bloom after each summer rain, are to be seen in most gardens. *Amaryllis Johnsonii*, here called the St. Joseph Lily, is plentiful and considering that it never sets seed and all multiplication is asexual it must have been brought here long ago to have become so widespread in central and south Louisiana. *Crinum americanum* and *Hymenocallis occidentalis* are indigenous to the area. The latter, known as the White Spider Lily, lines

the ditches and covers the low meadows with its spidery white bloom in early spring. These are in bloom at the same time as the native iris and grow in like situations. A summer blooming *Hymenocallis* though not a native is widely grown. This is the *Hymenocallis* of which Elizabeth Lawrence writes in her article in the 1943 *Herbertia*. Blooming in late June and thru August, its large white clustered blossoms lend sparkle to the summer garden. *Narcissus Tazetta*, Jonquils and many *Crinums* abound in old gardens and cemeteries where they have persisted for generations and their varietal identity has, in many cases, been lost. *Lycoris radiata*, the Red Spider Lily, does well. It multiplies rapidly forming clones that cover wide areas and sending up its showy blooms during September.

L. aurea appearing simultaneously, or slightly earlier, is distressingly parsimonious with its bloom, though it will, when given due attention, yield gold that fully repays such care. I have in mind a small clone growing in a shady, fern-covered nook. The camera, (Plate 312) attempting to reproduce all of the beauties of the surroundings, was unable to do full justice to the warm golden shadows that lie in the heart of this glorious flower. The degree of shade given these bulbs affects their blooming time; by planting some in full sun and some in shade their blooming period may be extended considerably, those in shade blooming first.

Besides these old favorites, I have succeeded with species and varieties which are not grown generally in this area. Some years ago I tried hybrid *Amaryllis* as pot plants. Finding that they did poorly I tried them in the garden where they have thrived and yielded satisfaction immeasurably beyond the care demanded by them. I have grown hybrid *Amaryllis* both in New Orleans and Baton Rouge and have hybridized extensively in the latter place. My hundreds of seedlings are now progressively yielding bloom that are a constant source of delight. These usually come into bloom from the end of March to the first week of April. No winter protection is given these bulbs and the culture they receive is only that which is accorded other garden plants. Discovering that these succeeded in the open, I sought to know other members of this interesting family.

Amaryllis belladonna Linn., non Ait. (syn.—*A. equestris* Ait.) grows and multiples in the garden but as a pot plant it is a more dependable bloomer. Its red-orange flowers with greenish white throat are in bloom in February indoors but not until late April in the garden. When established, the striking scarlet blooms of *Sprekelia formosissima* also appear at this time. Most *crinums* found in this section have long, trumpet-shaped blooms which hang their heads. There were no good whites. Hoping to secure a good white, I first sent for *Crinum Powellii album* and *C. bulbispermum album* (syn. *C. longifolium album*.) I was delighted to find that the flowers of *C. Powellii album* were not only a beautiful clear white but tulip-shaped, a flower form which was then scarce among the *crinums* grown locally. *C. bulbispermum* turned out to be a purer white than the one found locally and I was grateful for its aid in identifying the older *Crinum*. *C. scabrum* is the next in bloom



Lycoris aurea
Photo by Herbert V. Kelley

and its wide white petals striped with clear deep red are of good form with heads held horizontally. This is one of the best of the Milk-and-Wine types having a spring and fall blooming period. Although it sets seeds which germinate readily it is slow to mature and multiply. Among the pink crinums, *J. C. Harvey* and *H. J. Elwes* have made nice clumps but have not bloomed. *C. Cecil Houdyshel*, while only planted last year, already has its second bloom stalk, the first appearing on May 25th. An unknown pink crinum is called *Ivy Powell*, a friend and neighbor, since the original bulbs were brought from her family plantation. It has a lovely shell pink flower and blooms four or five times a season. Its flowers are held erect, the broad segments flaring open and recurving. It resembles a liliun rather than a crinum. *Ellen Bosanquet* has handsome rose-red flowers; although it is said to be the deepest red crinum, I have in my garden an unidentified crinum with much darker red flowers. This interesting unknown has a three foot crown of leaves surmounting twelve to fourteen inch neck. The long and narrow segments are flushed with the color of the reverse of the petals which are a deep wine-red approximating the color Hollyhock (53 L 11- Maerz & Paul). The tube is also this rich color and the heavy clusters of flowers produce a striking picture. *C. fimbriatulum* comes into bloom in mid-August and its white salverform flowers have a pale pink stripe. Opening at dusk, it perfumes the night air and four to six blooms open in pairs on each succeeding evening. The first frosts usually find this crinum still in bloom. Its wide segments outspread to form a six-pointed star and give it the name of Star Lily. A crinum brought from Mexico (Plate 313) and tentatively identified as a *Moorei* hybrid is doing exceptionally well. It is a creamy-white with black tips on petals and sepals. On opening in the evening the anthers are gray and crescent shaped and darken to black during the first day, straightening as they mature. It remains open two days and is very fragrant. Its leaves are quite short, a good characteristic as most crinums take considerable space in the flower border. In an exchange of bulbs with Mr. L. S. Hannibal, I was so fortunate as to obtain a bulb of *C. Frank Leach* which flourishes but has not as yet bloomed, having been planted just last fall.

Agapanthus have usually been considered pot plants in this section but I have *A. orientalis alba* and *A. longispathus* in the open. While they are on the south side of the house, they are not protected and have come through two winters unharmed. *A. longispathus* has bloomed with the coming of each spring around the end of May.

Zephyranthes atamasco, the lovely white wild Easter Lily of the East Coast is a shy bloomer with me. *Z. citrina* is a good clear yellow and blooms generously. I have a yellow *Zephyranthes* from an old plantation garden which duplicates the color but differs in size, having shorter leaves and smaller flowers. I would hesitate to identify it as being the same species notwithstanding that they exhibit the same fertility and appear identical in many other respects. *Z. Ajax* is a paler yellow, somewhat larger than *Z. citrina*. It blooms here in June and the white selections of this hybrid are a pleasing variation for no other white is then in bloom. *Z. candida*, Mr. E. L. Brasol's cross between *Z.*



Unidentified *Crinum*; probably a cultivated hybrid.
Photo by Herbert V. Kelley

Ajax and *Z. candida*, is a lovely straw yellow displaying the form of *Z. candida* but blooming at the same time as *Z. Ajax*. *Z. aurea* and *Z. treatiae* have not yet bloomed for me. *Z. rosea* and *Z. insularum* were planted this past winter and I am eagerly looking forward to their blooming.

Cooperia pedunculata does exceptionally well here and sets seeds generously which germinate within five days if harvested and sowed immediately after the necessary minimum of drying. Its lovely white flowers which open in the evening and remain open throughout the following day fade to pink under the sunshine. They surprise one by literally leaping up after the early spring rains. Their first bloom has appeared as early as the last week in March.

The most astonishing characteristic of the *Habranthus* is the wide disparity in size and color among the various species. *H. Andersonii* with yellow flowers washed red on the outside is very tiny. *H. robustus*, on the other hand, is as large as *Zephyranthes grandiflora*; its handsome pink and white flowers are the first of the *Habranthus* to appear in early June. *H. brachyandrus* is the giant of the three with which I am familiar. Its orchid-pink flowers shading to magenta at the base are as large as one of the smaller *Amaryllis*. If the flowers flared open and were not so tubular, they would be much more attractive.

The only *Alstroemeria* grown in this section is *A. pulchella* Linn. (*A. psittacina*, Lehm.) which is commonly known as the Parrot Lily. I have tried without success to grow *A. lutea*, the Chilensis hybrids and the white *A. pelegrina*. Considering how easily *A. pulchella* grows, I was perplexed by my failure until I heard Mr. William Lanier Hunt last fall in New Orleans explain that the soil in which alstroemerias are grown should not go above 65 degrees in summer. The coloration of these species is what attracted me as the red, green and maroon spotted, flowers of *A. pulchella* are bizarre rather than beautiful. However, I am determined to make another effort to grow these more desirable forms in the shade and cooler spots of my garden.

Mid-June finds the beautiful *Crinodonna Howardii* (syn. *Americrinum Howardii*) in full bloom. It is truly the belle of the summer garden with the pearly pink of its blooms held high above the foliage. Here it blooms monthly from June until late November.

Allium tuberosum does well for me, forming nice clumps which bloom profusely in mid-summer. Its small cluster of clear white flowers are attractive in the garden as they are carried well above the foliage on stems which do not need staking. They also make fine cut flowers and I keep them cut for fear of having them become the nuisance that *Nothoscodum inodorum* is in this area.

On learning that *Lycoris radiata*, which is still called the "Guernsey Lily" in this section, was not a Nerine, I tried to secure bulbs of the true Guernsey Lily. Being unable to do this, *Nerine Bowdenii* and *N. filifolia* were tried. Neither survived its first winter which was an exceptionally wet one. I hope to try these nerines again, being hopeful that better drainage is what they need.

Lycoris squamigera, *L. incarnata*, and a white form of *L. radiata*, have been tried. While all have survived and multiplied, I have had no bloom from any of them. I made the mistake of moving them when they failed to bloom hoping to find a location more to their liking. Since it appears that they resent this, I have let them remain in one place. I made the same mistake with *Brunsvigia rosea*. Fortunately two bulbs escaped my mistaken kindness and have multiplied and bloomed in September the past two years. The flowers are white with a light pink tint on the outer ends of the segments. Another bulb, *Brunsvigia rosea minor*, bloomed a week after planting and seemed to duplicate the above, the scape being shorter which may have been the result of recent planting.

A mere list of the amaryllids which I have tried cannot adequately convey the enjoyment that I have derived from their nurture and the charm which they lend to my garden. The success that I have had, while perhaps not unusual, has served to intensify my enthusiasm for this branch of gardening and to determine me to seek more and more of this pleasure.

SEMI-HARDY CRINUMS

L. S. HANNIBAL, *California*

Dean Herbert, who passed away a century ago, holds the undisputed lead as a *Crinum* collector and breeder. The world now knows little of the crosses that he effected and the writer doubts if any of his specimens still exist. Still his work was not in vain for he showed that the species of the genus *Crinum* were among the easiest of the Amaryllids to hybridize, and others have readily effected new crosses of their own. Some of these latter hybrids, being fairly hardy, have come into general use, and others being more tender have failed to survive unless grown in subtropical areas. Just how many *Crinum* hybrids exist is anyone's guess, but of the semi-hardy only a score or so can tolerate climatic conditions bordering the north edge of the Citrus belt. In other words there are only a few good Crinums that the writer deems worthy of listing as outdoor or cold greenhouse plants. Time may turn up a few more, but not many.

For a number of years *Crinum Ellen Bosanquet* has been considered one of the most colorful hybrids. The bulb needs some protection from the cold damp in the winter and not too much summer sun, but the delicate rose-purple shading and aromatic fragrance of the flowers warrant all the care that the plants require. In 1939 the writer ran across another example of Mr. Bosanquet's creations; this was *Crinum Louis Bosanquet*, which is equal to if not more attractive than, *Ellen Bosanquet*. This lesser known plant has viable pollen and has given rise to some interesting seedlings, none of which the writer has grown, but have been crossed with Mr. Houdyshel's *Crinum* hybrids such as *Gordon Wayne*.

However, the finest of the recent *Crinums* similar to the *Bosanquet* hybrids came through the success that Dr. Traub has had in crossing *Crinum scabrum* (seed parent) and *Ellen Bosanquet* (pollen parent). Out of a number of interesting F-1 seedlings, one of particular merit appeared, which was deeper and richer in texture than the rose-purple pollen parent, *Ellen Bosanquet*. This splendid hybrid which Dr. Traub has named *Elizabeth Traub*, in memory of his mother, the late Mrs. Elizabeth Graf Traub, will be available shortly to *Crinum* collectors. Mr. Houdyshel showed the writer quite a clump that was in bloom and it is an admirable addition to the bulb garden. The writer is pleased to have this opportunity of mentioning this clone in connection with the other semi-hardy *Crinums* considered in this article. [Editorial note.—The *Crinum Elizabeth Traub* is more vigorous, and has longer leaves than *Ellen Bosanquet*. In a recent letter (8-21-1947), Mr. Houdyshel writes,—“Examination this A. M. showed 13 florets in the . . . umbel of *Elizabeth Traub* . . . there were no *Ellen Bosanquet* with that number. The color of *Elizabeth Traub* was much darker and richer . . . ”.]

As far as known Mr. Bosanquet did not reveal the *Crinum* species that he used in making his crosses. Several hybrids, the best in fact, did not flower until after his death in 1930. Thus there has been some speculation whether *Crinum Moorei* or a *Moorei* hybrid was involved. From the standpoint of hardiness the evidence indicates such, since few other *Crinum* species contribute this factor which is so all important in this area. However others have expressed views otherwise. The proof will probably lie in a critical examination of seedling throwbacks that some Texas and Florida growers have been able to effect.

The well known *Powellii* hybrids (*Crinum bulbispermum* x *C. Moorei*) represent the hardiest of old time hybrids. The first of the crosses came from Sir W. Bowman's garden near London in 1887. The cross has been repeated a number of times, notably in Holland, and several of these plants have much in their favor as far as outstanding quality is concerned. Unlike many Amaryllids both *C. Moorei* and *C. bulbispermum* (The latter is also known as *C. capensis* and *C. longifolium*) are variable within the species. Quite a bit of individual variation exists in color, width of segment, and flowering date. In fact the writer has one clone of *C. bulbispermum* that came from Mr. Hayward some years ago that may throw white flowers at one time and light pink the next, or more often the two colors may appear in the same umbel.

Obviously with so much variation within the species it follows that considerable variation occurs in the various *Crinum* X *Powellii* clones that have been developed. In the course of the last ten years the writer has picked up a score of forms, several of outstanding quality. One came from the Ivy Powell estate near Baton Rouge, where it has been grown for years (We have reason to wonder if there was some connection between the Powell family and Sir Bowman), another came from Australia, and still others came from local sources. Even *Crinum Cecil Houdyshel* is considered a *Powellii* cross, although it is not exactly

typical of the usual *C. Moorei* x *bulbispermum* hybrids. All in all the *Powellii* types are hardy to cold and drought, and they multiply rapidly, so it is not surprising to find many forms scattered about.

Other *Crinum* crosses on *Crinum Moorei* are not uncommon. The writer introduced *Crinum Frank Leach* as a *Moorei* type. Subsequent breeding experiments have caused us to conclude that the plant is a tetraploid hybrid, an amphlidioid to be exact, since so many of its seedlings revert to a *Moorei* plant of lesser stature with shorter scape. At one time too we thought the plant a local find, but the clone is scattered about the south to some extent, even to Key West.

Luther Burbank made a number of *Crinum* crosses, two of which are occasionally found in circulation. One of the white forms, commonly found about Riverside, Calif., produces viable seed, and the writer has grown and flowered a number of these. It is apparent that this hybrid of Burbank's was a *Crinum Moorei* X *C. erubescens* cross since several of the seedlings are very characteristic of the well known *C. erubescens* species, whereas others are the *Moorei* type. In the writer's experience the seedlings were not easy to bring to maturity, but once established neither central California's summer drought nor winter rains seem to bother the plants. They thrive in spite of all neglect, but we have still to see an offset.

Crinum erubescens itself is an attractive plant. The white flowers with their delicate pale pink keels are exceedingly graceful. In winter hardiness this species stands up as well as *C. Moorei*, but obviously not as well as the tough old *C. bulbispermum*. The latter is reported to exist in protected outdoor locations as far north as Washington, D. C.

"Walking stick" *Crinums* may be a new term to many, but it is a common nick-name applied to any long scaped *Crinum* in Australia. The climate of New South Wales is particularly mild and a wide selection of Amaryllids have been grown there for a century or more. For fifty years or more extensive breeding has taken place in all lines of horticulture due to the prestige offered in taking the coveted Baptist award, which is issued annually by the Royal Horticultural Society of N. S. W. for the best flowers of the year. Occasionally an Amaryllid has taken the prize as *Nerines*, *Amaryllis*, *Clivia*, *Brunsvigia multiflora*, or *Crinum* hybrids are often entered. To qualify three bloom or umbels must be presented, and many a "walking stick" has been severely criticized due to the scape being out of proportion to the size of the umbel or plant. Those plants that have been accepted are usually well balanced in form and have excellent quality. In many cases they receive names, like the "Amaryllis Baptisti."

Crinum George Harwood is the only named Australian clone that the writer has seen to date, but it is definitely an outstanding hybrid. It is one of H. B. Bradley's productions that was first observed flowering shortly after his death in 1918. *Crinum* hybrids *George Harwood*, *Cummins*, and *H. B. Bradley* were all seedlings from the same cross on one of his hybrid "Walking sticks;"—a bulb that is now lost. However there seems to be considerable similarity between this lost clone and

Crinum Ellen Bosanquet, as the plants have a number of similarities. The hybrid *George Harwood* is a bicolor, white and deep rose, and although the flowers are shaped like *Ellen Bosanquet*, the wider perianths give the blossoms of *George Harwood* more of a chalice shape. This form in combination with the coloring and exquisite fragrance has produced a prize that has no equal in this country.

The Bradley hybrids, at least the three clones named above, may hold the record for length of their leaves. Those of *George Harwood* are some six feet long. The species *Crinum Kirkii* may throw four or five foot leaves, and undoubtedly other species do likewise, but six feet seems a bit out of the ordinary, yet it is not unattractive.

Actinomorphic Crinums. Thus far we have confined our discussions to the *Crinum* subgenus *Codonocrinum*, a group that has funnel form flowers borne on a curved tube. The subgenera *Stenaster* and *Platyaster* are distinct in that the segments are ray-shaped and borne on an upright tube. The Species *Crinum americanum* found in the Florida swamps is typical of this ray-form (See Bailey's Cyclopedia of Horticulture, Page 893). Plants of the ray-formed flowers are mostly tropical or sub tropical, although some of the Asiatic forms do grow in southern Japan.

On the whole though it is a rare discovery to find one that will grow outdoors in Southern California, let alone central California. The writer has tried *Crinum asiaticum*, *C. americanum* and *C. caribaeum*. Only the last has ever flowered, and this was in an unheated greenhouse. Thus it was with some surprise to find that a recently contributed plant defied our climate and really thrived here. This bulb, belonging to the *gigantum* group, (The name is misleading as the "Gigantum" crinums are all small plants) was collected by the Reverend Lyman Morse in the upper Congo in 1895. He reports it as growing in abundance in an almost inaccessible area along the banks of the Lukunga river. Like most of the "Actinomorphic" flowered Crinums this species requires considerable moisture for growth, but it makes an exception to the usual requirements of an acid soil that is so typical for bog plants. That, plus a fair degree of hardiness and a tendency to multiply rapidly by stolens, makes it a plant that will eventually be in general distribution. The wide, marble white, strangely reflexed petals will capture the heart of any *Crinum* fancier. We believe that it is a new species, but a better understanding as to species differentiation in the "Gigantum" group is desirable before passing final judgment.

Excluding the hybrid *Crinum Edmund Sturtavent*, the writer knows of no hardy, or semi hardy Crinums involving *Stenaster* or *Platyaster* blood. *C. Edmund Sturtavent* is somewhat an exception in more than one way. The *C. Moorei* parentage introduces hardiness and the *C. asiaticum*, size. Likewise it crosses a zygomorphic flower with an actinomorphic to give a sterile zygomorphic seedling (Herbertia Vol. 11, Page 258). Altogether it is a type of cross that one is not likely to find often nor do easily.

Crinum Breeding. *Crinum* breeding involves no special requirements other than suitable climatic conditions, which means warmth and proper humidity. Most of the *Crinums* are nocturnal in that the blossoms open in the evenings, and the pollen is most potent then when fresh. Thus evening pollinations are the logical procedure. However there is one serious difficulty. If one is in an area where cold nights occur chances of many crosses taking are quickly eliminated. Many *Crinum* pollens become inactive at some critical temperature, which may be below 70° F. for some and 65° F. for others. Warm nights are most conducive to successful takes.

A special inducement to better pollinations can also be effected by breaking off a petal in the morning and treating the exposed break to a lanolin—phenoxyacetic acid wash, the same as is used to induce fruit setting on other crops. Pollination some eight hours later according to our New Zealand friends is far more likely to take.

The crosses that can be tried are endless, but if one wishes to show progress the selfing or crossing of existing hybrid stock, providing that it sets viable seeds, presents the quickest opportunity of something new. The F-2 seedlings from the Burbank hybrids, or *Ellen Bosanquet*, or Bradley's "Walking sticks" are a splendid example of this. Oftentimes though one may run into seedlings that are throwbacks to one of the original grand parental species. The writer has in mind a score or so of perfect "*Mooreis*" that appeared out of the blue from one of the Houdyshel hybrids. Then again albino plants, or ones that multiply by numerous offsets often appear. The albinos die due to lack of chlorophyll, and the "Horse Teeth" or splitters never get to be of flowering size.

The formation of species throwbacks from a viable hybrid is not uncommon, as geneticists have reported many instances of such in the literature. However practically all cases cited deal with plants not belonging to the Amaryllidaceae. Dr. Edgar Anderson was the first to note that multiple characteristic linkages appeared in Daffodil hybrids at Oregon Bulb Farms, and attributes the cause to a strong tendency for the plants to try to retain their original, or part of their original chromosomes as a species entity. (In other words the chromosome groupings that entered a hybrid try to breed out in their same relationship as they entered.) The same occurs in *Brunsvigia multiflora*, *Clivia*, *Nerine*, *Cooperanthes*, and undoubtedly a number of other Amaryllids. At first it seems unusual that so many Amaryllidaceae hybrids should behave thus, but on the other hand it can be a common cytological behavior that marks the *Amaryllidaceae* apart from the *Liliaceae*, *Bomareaceae*, or *Iridaceae* families.

As a consequent specie throwbacks amongst the *Crinum* hybrids can be expected, and the quantities will vary from practically none to 100% depending on the hybrid clone used. If such occurs the only way to circumvent it is to look for breaks and to carry on to another generation using such plants. Perhaps some day *Crinum* hybrids will be as diversified as the Tall Bearded Iris, but it will take involved breeding,

many thousand-fold more complex than Dean Herbert envisioned when he attempted to solve the riddle of hybridism on the basis of his *Crinum* crosses.

HYMENOCALLIS CARIBAEA

W. M. JAMES, *California*

The specimen of *Hymenocallis caribaea* illustrated (Figures 185 and 186) was produced from a bulb collected in Jamaica by Mr. A. C. Splinter. This bulb was dug in July 1945 and all foliage cut off before being packed. It was received in Santa Barbara in November of the same year and was planted in Mr. Splinter's glass house. Although the bulb did not bloom until July 1946, which is a little later than normal, the flower was of good size and quality considering that this species of *Hymenocallis* is evergreen, does not take any prolonged rest period and was out of the ground and in transit for about four months. This umbel

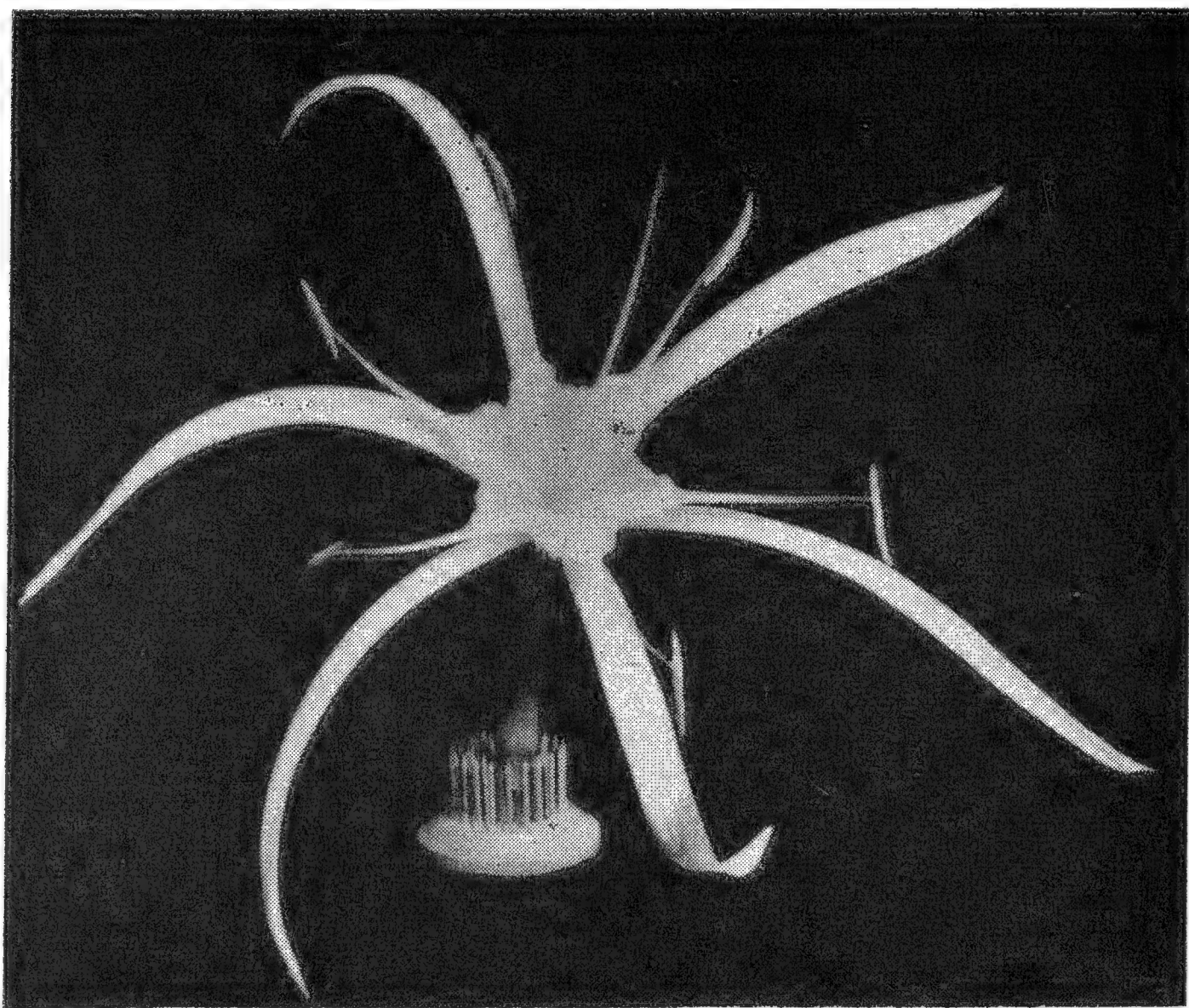


Fig. 186. *Hymenocallis caribaea*; single flower about half natural size. Photo by W. M. James. [Fig. 185 on page 170.]

had twelve blossoms. Mr. Splinter says that in Jamaica there are up to thirty blossoms in one umbel and the stems are up to three feet long. The leaves are pointed, narrowed at the base, three to four inches wide in the broadest place, are two to three feet long and resemble *Eucharis* foliage more than the leaves of other *Hymenocallis*. This is a beautiful flower with a delightful fragrance, but it can not be grown out of doors to any advantage in Santa Barbara.

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(e) SCORE CARDS FOR HYBRID AMARYLLIS AND HEMEROCALLIS

(a) *Hybrid Amaryllis*. For classification of flower types and score card for Hybrid Amaryllis see HERBERTIA, Volume 5, pages 141 to 145, 1938.

(b) *Hemerocallis Score Card*. For the official score card for Hemerocallis see HERBERTIA, Volume 7, page 126, 1940.

II. PUBLICATIONS OF THE AMERICAN PLANT LIFE SOCIETY

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(AMARYLLIS FAMILY).

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Volume 7 (1940). DEDICATED TO LATIN AMERICA, and featuring articles on Latin American amaryllids; biographies of Drs. Philippi and Holmberg; report by Dr. Goodspeed on the amaryllids collected by the Univ. of Calif., Second Andean Expedition; reports on the flowering of the "Blue Amaryllis," *A. procera*; and many other important articles on the description, propagation, breeding, culture, harvesting and storage of amaryllids. Of special interest are the important articles on the description, breeding and culture of daylilies by noted authorities. With 45 illustrations—30 plates and 15 figures—and a total of 242 pages.

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Volume 13 (1946). FIRST NARCISSUS EDITION. Dedicated to Guy L. Wilson, the noted *Narcissus* breeder. This volume contains an autobiography of Mr. Wilson, an article on his breeding activities; an article on *Narcissus* breeding in Australia by Mr. Alston; articles by American *Narcissus* breeders, including Frank Reinelt, E. P. Powell, J. S. Cooley, C. W. Culpepper and W. R. Ballard; an article on the karyology of the subgenus *Ajax* of the genus *Narcissus* by A. and R. Fernandes; a list of parents of hybrid *Narcissus* by Arno H. Bowers; *Narcissus* diseases by C. J. Gould; *Narcissus* insects and mites by E. P. Breakey; *Narcissus* culture by various authors. There are also articles on other amaryllids—*Hemerocallis*, hybrid *Amaryllis*, *Habranthus*, *Crinum*s, *Lapagerias*, *Agapanthus*, *Hymenocallis*, etc. Thirty-nine illustrations—186 pages.

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HERBERTIA

VOLUME 15

2ND SOUTH AFRICAN EDITION

EDITED BY

HAMILTON P. TRAUB

HAROLD N. MOLDENKE

THE AMERICAN PLANT LIFE SOCIETY

Box 2398, STANFORD, California

1948

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The American Plant Life Society,

Box 2398, Stanford, California

P R E F A C E

The present issue of HERBERTIA is the 15th volume in the series. As indicated in Vol. 10, it is suggested that the issues be bound in groups of five for ready reference. To this end, the title page and accompanying pages, for vols. 1—5, incl., and vols. 6—10, incl., were included at the end of vol. 10; and those for vols. 11—15, incl., are included at the end of the present volume (vol. 15). An index volume to vols. 1—15, incl., will be published separately, and will be announced as soon as ready.

It is with the deepest regret that we record the death of Mr. J. Marion Shull. He died unexpectedly of cerebral hemorrhage on September 1, 1948, at the age of 76 years. He had prepared with keen insight the article on Kodachromes for 1948 HERBERTIA a few weeks prior to his death, and at the time of his passing he left the unfinished cover design for 1948 PLANT LIFE. Apparently this was his last artistic work, and although it was unfinished, it was far enough along so that it could be used for the intended purpose as the cover design of the AROID LILY EDITION of PLANT LIFE. We also record with the deepest regret the death of Mr. Fred H. Howard, and Mr. Dickinson in 1948. In memoriam notices for all three will appear in 1949 HERBERTIA.

This 2ND SOUTH AFRICAN EDITION of HERBERTIA is dedicated to Dr. R. A. Dyer, who received the 1948 HERBERT MEDAL for his valuable article on the genus *Cyrtanthus* that appeared in 1939 HERBERTIA. In the present issue Dr. Dyer favors us with a brief autobiography, and articles on "Further Records of South African Amaryllids" and a new *Crinum* species. Other contributions from South Africa are, "The Clivias at Scott's Farm, Grahamtown" by Mrs. Cythna Forssman, who also produced the beautiful cover design based on "a drawing in Heister's original work on the genus *Brunsvigia* (1755) and is not intended to be botanically correct"; and "Notes on Some Cultivated *Amaryllidaceae* in Transvaal, South Africa." In addition there is a report on South African raised hybrid *Amaryllis* by Mr. A. C. Buller, and the first installment of two articles by Mrs. Coombs on "South African Amaryllids as Pot Plants." A request for articles was sent to the scientists at the BOTANICAL GARDEN, STELLENBOSCH, but the articles had not arrived at the time of publication, apparently due to post war conditions. We hope that they will again be represented when the 3RD SOUTH AFRICAN EDITION is published at a later date.

There has been a generous response for other amaryllid articles. Capt. Harding contributes notes on the amaryllids of the Holy Land. There are some very interesting reports from the *Hemerocallis* Trial Gardens at Greenwood Park, Des Moines, Iowa; the Texas Agric. Expt. Station; the University of Florida, and Cornell University. Mr. Gilmer, Miss Lawrence, Mr. Ballard, Dr. Cooley and Mr. Saxton have also favored us with valuable articles on *Hemerocallis*.

In addition to the article on the Buller Hybrid *Amaryllis*, Mr. Smith, Mr. Hermon Brown, Mr. Hayward, Ludwig & Co., and Dr. DuPuis also contribute articles on this popular group of plants. The reader's attention is directed particularly to the stimulating article on growing

Amaryllis in the home by Mr. Leonard C. Smith. It is hoped that this revealing article will stimulate others to write about their similar experiences with hybrid *Amaryllis*.

There are also interesting articles by Messrs. Foster and Boehringer on *Alstroemerias*; Dr. Brierley on *Amaryllid* diseases; Dr. Anderson, Mr. Wilson, Mr. Hornback, Mr. de Graaff, Mr. Ballard, Dr. Cooley, and Mr. Mitch on *Narcissus*; Mr. Purdy on *BRODIAEA LILIES*; Mr. Hannibal on *Haemanthus*; Mr. Hayward on *Crinums*; and Mrs. Strout and Mr. Wolfe on various amaryllids.

The 1949 issue of *Herbertia* will be the 1ST AUSTRALIAN EDITION, and it will be published in December 1949. The HYBRID AMARYLLIS EDITION, dedicated to Mrs. Mary G. Henry, will appear early in 1950.

September 20, 1948

Hamilton P. Traub
Harold N. Moldenke

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When taking photographs of amaryllids, an effort should be made to include the whole plant—*stem*, if any, *leaves*, *scape* and *flowers*. Separate views of the *bulb* and *roots* are also valuable in some cases. These remarks do not apply to cut-flowers.

NOTE FOR MEMBERS AND LIBRARIANS

The first series of *HERBERTIA*, comprising vols. 1—15, incl. (1934—1948), is completed with the present issue. For convenience in reference, it is suggested that these volumes be bound in groups of five. The title pages for binding vols. 1—5, incl., and vols. 6—10, incl., will be found at the end of Vol. 10; and the title pages for vols. 11—15, incl., will be found at the end of the present volume. A separate index volume for vols. 1—15, incl. (1934—1948), will be published as soon as practicable. Publication date and price of the index volume will be announced later.

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CORRIGENDA

HERBERTIA, VOL. 13 (1946) 1948

- Page 3, 17th line (text) from top, for "of" read "for."
 Page 99, under 6b, B-2, for "telapsegs" read "tepalsegs."
 Page 100, 10th line from top, for "petelapseg" read "petepalseg."

CORRIGENDA

HERBERTIA, VOL. 14 (1947) 1948

- Page 19, 16th line from top, for "*sparaxis*" read "*Sparaxis*."
 Page 22, 6th line from top, for "*pariviflora*" read "*parviflora*."
 Page 56, 21st line from bottom, for "Hebertia" read "Herbertia."
 Page 58, 19th line from top, for "below" read "above."
 Page 62, 6th line from bottom, for "*Thumbergi*" read "*Thunbergii*."
 Page 87, 7th line from top, for "GALANTEAE" read "GALANTHEAE."
 13th line from top, before "Europe" add "North Africa,".
 Page 90, 5th line from top, for "*Salisb.*" read "Salisb."
 20th line from top, for "ed. 1289" read "ed. 1, 289."
 Page 92, 21st line from bottom, for "REJECTED" read "EXCLUDED."
 Page 93, under 1b, 3rd line, after "not lobed" add "except *L. Valentinum*."
 Page 96, 2nd line from top, for "(Simonkia)" read "(Simonkai)."
 Page 97, 1st line from top, after "not lobed" add "except in *L. Valentinum*."
 4th line from top, for "five" read "seven."
 Page 99, 21st line from bottom, for "1-valved" read "1- or 2-valved."
 Page 103, 5th line from top, for "Subgenusl" read "Subgenus 1."
 29th line from top, 9b, for "(Caucasus)" read "(Transcaucasus)".
 Page 106, 7th line from top, for "*Algae-Reginae*" read "*Olgae-Reginae*".
 Pages 106 & 107, place species 4 above species 5.
 Page 107, species 6, 2nd line, for "Shed." read "Sched."
 Page 109, 4th line from top, for "*Imperiati*" read "*Imperati*".
 Page 115, 2nd column, 2nd line, for "*Imperiati*" read "*Imperati*".
 Page 153, 9th line from bottom, for "above" read "below."

Dedicated to
Dr. R. Allen Dyer



Herbert Medalist— R. Allen Dyer

R. ALLEN DYER

AN AUTOBIOGRAPHY

The preparation of an autobiography is the penalty expected of a Herbert Medalist. Before I begin mine I wish to express my deep appreciation of the high honour of this award. It is too great a distinction for so small a contribution as I have made to the cause of the *Amaryllidaceae*. It would embarrass me more, were it not for the knowledge that it is a tribute at the same time to the *Amaryllidaceae* of South Africa, a group which has given to members of the society so much of beauty and interest. I am merely their representative for a fleeting hour, but let that pass.

My birthday was on 21st September 1900, the event taking place in the Union of South Africa, at Pietermaritzburg. My earliest memories are connected with gardening, for it was a family hobby. Within a stone's throw of our home in Jesmond Road, were growing wild groups of *Crinum* and an abundance of *Cyrtanthus* or "FIRE LILY."

Throughout my youth my interest in nature persisted. It had a setback through rheumatism, which laid me low in 1910 and dogged me at varying intervals for 20 years. It prevented me from completing the matric at Michaelhouse, where I had been a boarder from 1914, and this exam obstacle in ones education was eventually passed at St. Charles. Thus it was in 1920, at the Natal University College, Pietermaritzburg, that I began a science course with Botany (under Professor J. W. Bews) and Chemistry (under Professor R. B. Dennison) as major subjects. The B.Sc. was completed in 1922, and the M.Sc. in 1923. For a year after this I was occupied as a sugar chemist in Zululand, but an opening as a botanist in the Division of Plant Industry then came my way, and my botanical career began on 1st April, 1925, at Pretoria. After a fortnight there, I had my first transfer, which landed me in Grahamstown as assistant to Professor S. Schonland, who in addition to his university appointment, was then an honorary member of the Botanical Survey Advisory Committee. On Professor Schonland's retirement on 1st June 1926, I was placed in charge of the Botanical Survey of the Eastern Cape Area and at the same time was elected Honorary Curator of the Albany Museum Herbarium, Grahamstown.

My first avenues of botanical research were largely influenced by my contacts with Professor Schonland and Dr. R. Marloth, (whose portrait was reproduced in *Herbertia* vol. 6: 19 (1939) 1940). From these two eminent botanists I formed an early interest in succulents, and in particular, in the large genera *Crassula* and *Euphorbia*. For official reasons, however, my research has always covered a fairly diverse field.

The next and possibly the most important milestone in my career was my transfer oversea in January 1931, as botanist for the Union of South Africa at the Royal Botanist Gardens, Kew. The many facilities and contacts with eminent botanists, including Dr. J. Hutchinson (to mention only the one who has been introduced to readers of *Herbertia* by his

photograph in Vol. 6 as Herbert Medalist for 1939) have been a lasting benefit. During the time oversea it was my further good fortune to visit the main continental herbaria at Uppsala, Stockholm, Berlin, Vienna, Zurich, Geneva, Paris, Strasbourg and Leiden. It will doubtless be of interest to explain that the South African Government instituted a system of rotation of botanists to Kew in 1926, each officer to remain there for a period of two to three years.

On my return from Kew in 1934, I was again stationed at the National Herbarium, Pretoria, which has since remained my headquarters. It was in the following year that I was elected as a corresponding member of your Society, and I was soon busy with the preparation of an "Introduction to South African Amaryllidaceae" which appeared in *Herbertia* 3: 1936. Since then I have always kept a weather-eye open for interesting information about the family. In addition to my work on the genus *Cyrtanthus*, published in *Herbertia* Vol. 6, I have added several lesser contributions in *Herbertia* and in *Flowering Plants of South Africa*.

1937 proved another eventful year for me. My thesis on the vegetation of the Districts of Albany and Bathurst in the eastern Cape Province was accepted for the D.Sc. degree, and I had the privilege of a fortnight's trip on H. M. S. Carlisle to visit Thistan da Cunha. I reported later that I made no record of *Amaryllidaceae* on that "lonely" island, which is half way between the Cape of Good Hope and South America.

But the *Amaryllidaceae* did not cause my first excursion into American botanical literature. My interest in *Euphorbia* had drawn me into the *Euphorbia Review* of 1935 and into the *Cactus and Succulent Journal* not long after, while I was already in correspondence about *Stapelieae* with the two Americans, Alain White and Boyd Sloane. Later the three of us were associated in the production of two sizable volumes on the Succulent Euphorbieae of Southern Africa, published in 1941. In recognition of this we were elected Fellows of the Cactus and Succulent Society of America in that year, and in the following year the triumvirate were awarded Senior Captain Scott medals by the South African Biological Society.

Some further recognition of my botanical work was my admission in 1944 as a Fellow of the Royal Society of South Africa.

The quota which I have extracted from official hours has not been a complete deterrent to my taking an active interest in science and horticulture generally. From 1935, I occupied the position of Honorary Treasurer to the South African Biological Society, only to relinquish it this year to become President. Almost continuously during the same period, I have been Recorder of the Botanical Section at the annual conferences of the South African Association for the Advancement of Science, being President of the Section in 1941.

In 1943 the local Horticultural Society ran short of an Editor for their monthly bulletin known as *The Pretoria Gardener*, with the result that this was another straw added to the load of hay. One could mention

other distractions. I am hardly a model civil servant, for with all this I have over 450 days accrued leave.

Progress in my official capacity has been steady, even if not spectacular. The final relatively big jump in 1944 to Chief of the Division of Botany and Plant Pathology, on the retirement of my Chief, Dr. E. Percy Phillips, was by no means a foregone conclusion. The post of Chief carries with it, the Honorary title of Director of Botanical Survey, and the Editorship of South African Flowering Plants, the publication freely referred to by me in *Herbertia*, 1936. The attendant administrative duties of my present post are its least attractive aspects.

In my youth I was particularly keen on sport, representing my school and university college in rugby and cricket, and on occasions even representing my town in rugby and hockey. Do I mention also that I married Adeline Beatrice Cooke in 1926, and have three children, none of whom is taking up botany as a career. It is often remarked that a botanist by profession rarely chooses gardening as a hobby. My main hobby is still gardening.

FURTHER RECORDS OF **AMARYLLIDACEAE** IN SOUTH AFRICA

R. A. DYER

The article entitled "An Introduction to South African Amaryllidaceae" in *HERBERTIA* 3:37 (1936) was based largely on the species illustrated in the periodical "Flowering Plants of South Africa." In the next volume of *HERBERTIA*, p. 12, additional information was given, including a reference to *Cyrtanthus tuckii*. The particular plant in question was later illustrated in "Flowering Plants of South Africa" (F. P. S. A. 17:1937 plate 680) under the varietal name *C. tuckii* var. *transvaalensis* Verdoorn. The reference in *HERBERTIA* (l.c.) to the possible illustration of *Nerine* species was implemented in "Flowering Plants of South Africa" on Plates 658 and 679, where *N. angustifolia* Baker and *N. gracilis* R. A. Dyer, respectively, were figured, and the latter described for the first time.

Since the original description of *N. gracilis*, a Transvaal species, will not be available to many readers of *HERBERTIA* the main characters will be repeated here: *NERINE GRACILIS* R. A. Dyer, *Herbertia* plate 315, fig. 1 and 1a. *Bulb* 1.5—2 cm. thick, elliptic-globose, contracted into a neck 3.5—5 cm. long, covered by membranous remains of leaf-bases. *Leaves* 3—5, contemporary with the flowers, up to 30 cm. long, 1.5—2 mm. thick, filiform, subterete, concave or shallowly canaliculate above, very minutely papillate. *Peduncle* terete, slender, shorter than the leaves, up to 20 cm. long, 2—2.5 mm. thick, very minutely papillate and occasionally with a few scattered, transparent hairs. *Spathe-valves* more or less 2 cm. long, narrowly lanceolate-acuminate. *Flowers* 8—10 in a centripetal umbel, markedly protandrous. *Pedicels* 4—7 cm. long, 1 mm. thick, terete. *Perianth-segments* about 1 cm. long, the outer ones about 4.5 mm. broad and the inner ones slightly broader, elliptic-oblong, rose pink (Ridgway

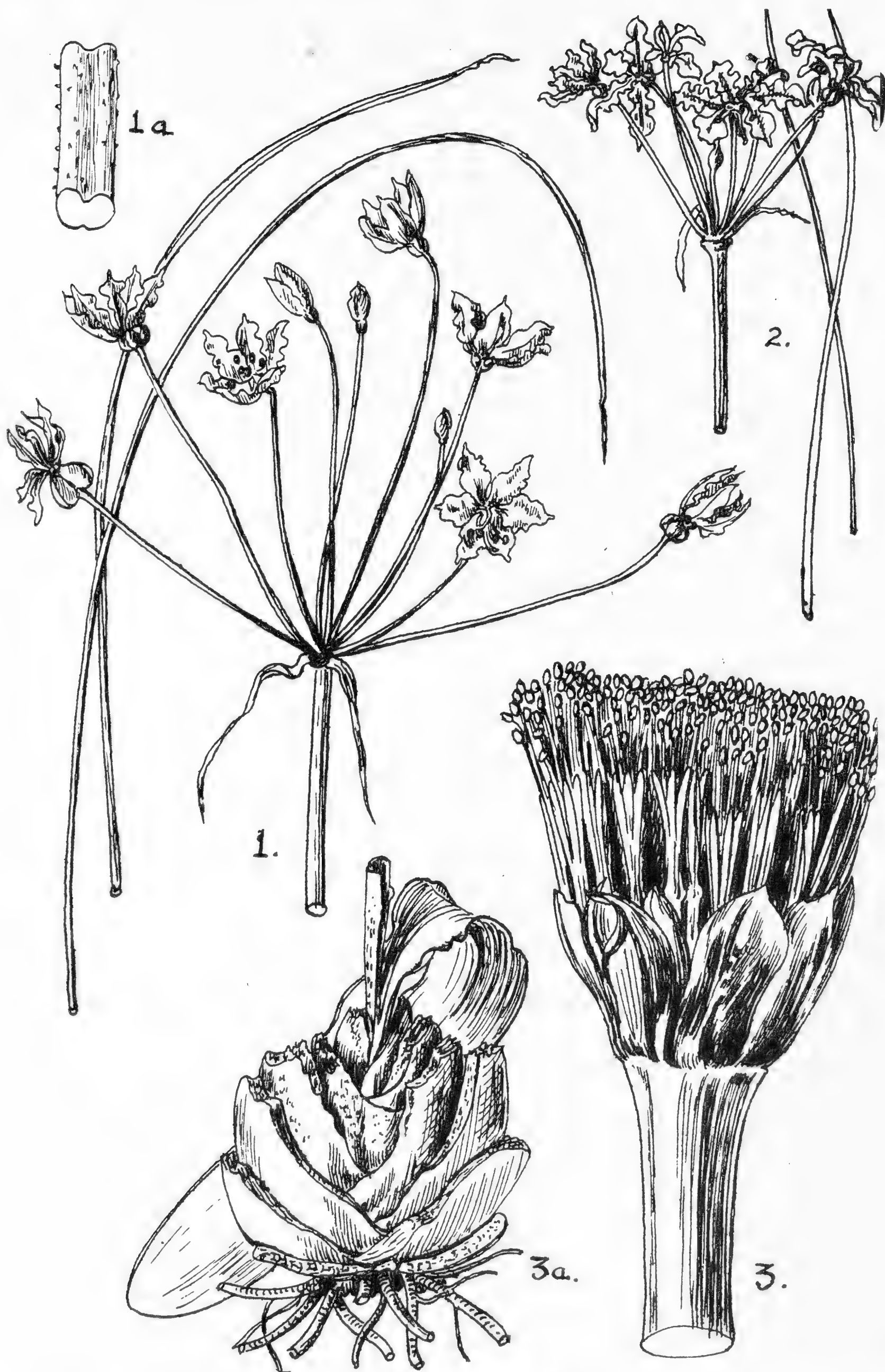
XII) green-keeled on the back above the middle, with the margin undulate minutely cuspidate at the apex. *Filaments* appendiculate behind the base with an oblong deeply 2—3-lobed rarely fimbriate process, at first sub-erect, later decurved after dehiscing of anthers; anthers 2.5 mm. long, oblong, the three opposite the inner perianth-segments maturing before the others. *Ovary* triangular; style at first decurved, later erect; stigma minutely trilobed. *Capsule* obtusely trilobed or subglobose, with 1—2 subglobose seeds in each cell.

In "Flowering Plants of South Africa" 1937 also, *Tulbaghia alliacea* L. f. was figured on plate 653. This is an old established species and needs no elaboration, but comments on the genus will be found later under *T. ludwigiana* Harv. More well documented species in the family appeared in the following volume; *Cyrtanthus flanaganii* Baker (plate 693), *Haemanthus nelsonii* Baker (plate 695), the ill fated *Ammocharis coranica* Herb. (plate 712), the less known *Nerine frithii* L. Bolus (plate 691) and *N. hesseoides* L. Bolus (a new species on F. P. S. A. plate 683). *Ammocharis coranica* is termed ill fated because it was first figured (plate 230) under the name *Buphane disticha* and in plate 712 the old leaves are shown with tips intact, whereas in nature they are always shrivelled. In the text for *N. frithii*, Dr. Bolus is of the opinion that the plant previously published under that name (F. P. S. A. plate 132) is distinct and it is given the specific epithet *transvaalensis*.

NERINE *hesseoides* L. Bolus, Herbertia Plate 315, fig. 2. The description runs as follows: *Plant* glabrous, 17—25 cm. high. *Bulb* ovate, up to 3 cm. long, 1.7 cm. diameter, produced into a neck; outer tunics thin and papery. *Leaves* 2—7, synanthous, linear, flat or slightly sulcate above, rounded below, up to 18 cm. long, 1—1.5 mm. broad. *Peduncle* terete, scarcely 2 mm. diam. *Spathes* up to 2.5 cm. long. *Umbel* centripetal, 6—14-flowered. *Pedicels* ascending or erect, 2—3 cm. long. *Perianth-segments* regularly placed as in the genus *Hessea*, linear, widened upwards, broadest near the middle, obtuse, margins conspicuously undulate in the lower part, usually up to 1 cm. long, up to 3.5 mm. broad. *Filaments* at first decurved, then erect, finally almost regularly disposed in the flower, unequal in length, 4—5.5 mm. long, appendiculate at base, the appendages almost free to the base, somewhat spreading upwards, acuminate, usually entire, up to 2 mm. long; anthers before dehiscence 1—2 mm. long; pollen whitish. *Style* at first decurved, finally curved upwards; stigma minutely lobed. *Ovary* at first acutely angled, 1.5—2 mm. long, 1.5 mm. diameter. *Capsule* globose, 6 mm. diameter.

Exceptionally, *Amaryllidaceae* were not represented in "Flowering Plants of South Africa" Vol. 19 (1939) and in Vol. 20 (1940) there was only one, namely *Haemanthus namaquensis* R. A. Dyer (plate 793). This plant, described then for the first time was an interesting addition to the genus. It occurs in those very arid parts in the west of Namaqualand near Steinkopf. Only two bulbs attached to each other were located and fortunately one of them flowered at Pretoria for figuring. The description is as follows:

HAEMANTHUS NAMAQUENSIS R. A. Dyer, Herbertia Plate 315, fig. 3 and 3a. *Bulb* compressed, flattened on two sides, composed of thick



South African amaryllids— 1. *Nerine gracilis* R. A. Dyer; 1a. same, section of leaf enlarged. 2. *Nerine hesseoides* L. Bolus. 3. *Haemanthus namaquensis* R. A. Dyer, 3a. same, bulb and leaf reduced.

bifarious scales, up to 10 cm. high, 12 cm. broad, 6.5 cm. thick, with a solid concave base, young scales pinkish. *Leaves* 2, suberect, lorate, up to 40 cm. long, 7.5—9.5 cm. broad, glabrous, without cilia on margin, somewhat undulate on the margin, and this more pronounced towards the base, somewhat glaucous, on inner and outer surface towards the base purple spotted and shortly banded with red. *Peduncle* about 8 cm. long, erect, compressed 1.4—1.5 cm. in its greater diameter, red. *Umbel* dense, surrounded by 7—8 large bracts with a few narrower ones within; outer bracts oblong, 3.25 cm. long, up to 1.4 cm. broad, obtuse, bright red, imbricate, erect. *Flowers* dense, well exserted from the bracts. *Pedicels* 1.5—2 cm. long, slender. *Perianth* about 2.3 cm. long, light pink towards the base, darker above, especially on the tips of the lobes; tube 4—5 mm. long; outer lobes 1.8—2 cm. long; inner lobes slightly shorter, thickened towards the tips and with a minute tuft of hairs from the inner surface of the apex. *Stamens* exserted from the perianth, about 3 cm. long. *Ovary* 4—5 mm. long, each cell with one ovule; style nearly equalling the stamens; stigma minutely 3-lobed.

In 1941 it was possible to figure that interesting plant *Cyrtanthus guthrieae* L. Bolus. As I have twice quoted the author's statement that "the spread of the perianth and the relatively *long* tube are more characteristic of *Vallota* than *Cyrtanthus*" it is as well to state that the author meant to write "relatively *short* tube," that is the perianth tube relative to the segments in the genus *Cyrtanthus*.

Following on the account of the genus *Cyrtanthus* in HERBERTIA 6 (1939) 1940 it was unexpected that two distinct plants would soon be received from the well botanised neighbourhood of Port Elizabeth. These were described under plates 867 and 868 of "Flowering Plants of South Africa" 1942, with the names *Cyrtanthus affinis* and *C. speciosus* respectively, while the beautiful *Nerine bowdeni* W. Watson followed on plate 841. To augment my account of the genus *Cyranthus* in HERBERTIA the two descriptions are added:

CYRTANTHUS AFFINIS R. A. Dyer, Herbertia Plate 316, fig. 1. *Bulb* egg-shaped, about 3.5 cm. in diameter, with a short neck 1—2 cm. long. *Leaves* 1—3, contemporary with the flowers, linear, 20—35 cm. long or sometimes longer, about 0.8—1 cm. broad, spreading, tapering gradually to a narrow base; not or only slightly twisted and the older ones occasionally recurved towards the apex; margin slightly folded upwards. *Peduncle* slender erect, about 15—18 cm. tall, 4—5 mm. diameter, hollow above solid towards the base. *Spathe-valves* 2—3, oblong or linear-lanceolate, up to 4 cm. long. *Pedicels* 1.5—3 cm. long. *Flowers* 1—4 on each peduncle, suberect or somewhat spreading; perianth white with cream tinge down centre of each segment, passing to light green at the base (flower white with pink marking; Copeman), about 4 cm. long or occasionally up to 5 cm. long; tube 2.25 cm. long with a short slender cylindric base from which it is dilated somewhat abruptly and thence gradually to the throat about 1.5 cm. wide; lobes ovate-oblong, 1.5—2 cm. or occasionally up to 2.3 cm. long. *Stamens* biseriate, included. *Style* exserted from the tube, trilobed.

This species is related to *C. clavatus* (L'Hérit.) R. A. Dyer but is a more robust plant generally, usually having far larger leaves and more than one flower to the umbel.

CYRTANTHUS SPECIOSUS R. A. Dyer, *Herbertia* Plate 316, fig. 2. *Bulb* subglobose, 4—6 cm. broad, slightly broader than tall, with a short neck about 2 cm. long. *Leaves* 1—3, contemporary with the flowers, 25—35 cm. long or somewhat longer, 1.25—2 cm. broad, spreading, recurved or curled inwards towards the tips but not spirally twisted, tapering gradually to apex and base, ribbed below and with margins folded upwards. *Peduncle* slender, erect, 5—7 mm. diameter, about 15—18 cm. long, hollow above and solid towards the base. *Spathe-valves* 3, oblong to linear-lanceolate, up to 4 cm. long, the outermost being the largest. *Pedicels* 0.5—3 cm. long. *Flowers* 2—6 on each peduncle, spreading or suberect; perianth creamy white with broad red or pink band down the centre of each segment, paling towards the tip, green with pink tinge towards the base, the intensity of colour being variable, 6—8 cm. long or slightly longer; tube 4—5.5 cm. long, evenly dilated from the base to the throat 1.5—2 cm. wide; lobes oblong-lanceolate, 2—2.5 cm. long, apiculate. *Stamens* inserted in 2 rows; the upper row slightly below the mouth and the anthers reaching the mouth. *Style* exserted, trilobed.

This species is closely related to *C. smithiae* Watt, but the leaves of the latter are strongly spirally twisted, whereas those of *C. speciosus* are not.

Following these, there were in 1943 *Clivia caulescens* R. A. Dyer (plate 891) and *Cryptostephanus vansonii* Verdoorn (plate 885) and *Crinum buphanoides* Welwitsch (plate 887). The first two species were then published for the first time and deserve some comment here.

CLIVIA CAULESCENS R. A. Dyer, *Herbertia* Plate 316, fig. 3. This is not altogether unlike *C. nobilis* Lindl. in its inflorescence, but is unusual in the genus in the development of a stout stem up to 1½ ft. long. It occurs in and near forests of the north-eastern Transvaal, growing in leaf mould amongst rocks, or sometimes even as an epiphyte several feet above the forest floor on slanting tree trunks, which have accumulated sufficient moss and decaying matter for the germination of the seedling. The seed would probably have been carried to such positions either by birds or other small animals. *Stems* branched from the base up to about 45 cm. long, 3.5—4 cm. diameter becoming leafless below with age and transversely ringed by leaf-scars at intervals of .5—1.2 cm. with a tuft of about 15 leaves at the apex. *Leaves* dark green, lorate, distichous but the blades spreading somewhat spirally, usually about 30—40 cm. long and 3 cm. broad, but may be up to 90 cm. long and 5 cm. broad, widening very gradually from the base for about 2/3 its length and thence narrowed gradually to the apex. *Peduncle* compressed, sharply 2-edged, unequally convex on the surfaces, about 30 cm. long, 1.5 cm. broad at the base narrowed to 1 cm. under the umbel. *Spathe-valves* 4, membranous, unequal, more or less lanceolate, 4 cm. long. *Umbel* about 15-flowered. *Pedicels* 1.5—3.5 cm. long. Perianth deep salmon, with the lobes green tipped, yellow on the overlapped margins, 3.5 cm. long, with a tube 4—5 mm. long and lobes slightly spreading at the tips; the outer lobes

elliptic to spatulate-oblong, 7 mm. broad; the inner lobes 1—1.2 cm. broad. *Stamens* about equalling the perianth lobes in length, inserted at the throat of the perianth tube and the base of the filaments projecting over the mouth of the tube and fitting closely round the style. *Ovary* about 5 mm. long; style extending about the same distance as the anthers. *Fruit* a berry, subglobose, about 1.5 cm. in diameter.

CRYPTOSTEPHANUS VANSONII Verdoorn, *Herbertia* Plate 316, fig. 4 and 4a (F. P. S. A. plate 885). When the plants of this species from Southern Rhodesia were first seen at the National Herbarium, Pretoria, they were not in flower and, on vegetative characters, appeared almost certainly to belong to the genus *Clivia*. This assumption was proved quite wrong when the plants flowered later. The perianth contained a corona in the throat and the stamens were inserted in two series. As at that time constituted, the genus *Cryptostephanus* consisted only of the type species, *C. haemanthoides* Pax, from Angola, so the addition of a second species from a remote station was of more than passing interest. Miss Verdoorn drew attention in her account to the similarity of her species to species of *Tulbaghia*, which also have a corona and stamens inserted in two series, but the barrier of the superior ovary of the latter is a vital distinction. *Rootstock* subglobose, tunicated, about 10 cm. long and 2.5 cm. diameter, for the most part above ground; roots cylindric, 5 mm. diameter, creeping near soil surface and partially above ground. *Leaves* 12 to 18, distichous at base, spreading above, lorate, up to 60 cm. long and 2.5 cm. broad, slightly narrowing towards base and apex, spreading recurved. *Peduncle* about 20 cm. long, strongly compressed, ancipitous. *Spathe-valves* several, unequal, withered. *Pedicels* green, terete, up to 3 cm. long. *Flowers* about 30 in an umbel, white tinged with pink about the throat, the basal portion surrounding the ovary and partly fused with its walls, greenish; perianth-tube from above ovary 7 mm. long; segments about 8 mm. long, spreading; the three outer slightly narrower than the three inner and with more obviously hooded apices. *Corona-lobes* 6, bifid, each lobe inserted at the base of a perianth-segment, yellow or pink, about 3.5 mm. long. *Anthers* in 2 rows, inserted in the tube; the 3 lower subsessile; 3 upper with filaments less than 1 mm. long. *Ovary* 3-chambered, ovules 2 to 4 in each chamber; style columnar, 3 mm. long.

Crinum buphanoides Welwitsch was figured on plate 887 of "Flowering Plants of South Africa" 1943. This plant differs quite appreciably from all other species of the genus recorded from Southern Africa in its very slender perianth tube and slender spreading segments. In these characters it is allied to a number of species from Tropical Africa belonging to the section *Stenaster*.

Volume 24 of "Flowering Plants of South Africa" contained only *Tulbagia ludwigiana* Harv. (plate 935) while *T. natalensis* Baker appears in Vol. 25 on plate 979. There is nothing outstanding about these species, but they give an opportunity of drawing attention to the fact that the rootstock of the genus *Tulbaghia* has been variously described as a "rhizome," "tuberous," "corm," "bulb," and "not bulbous." The rootstock in most species grows erect in the ground, is unbranched or



South African amaryllids— 1. *Cyrtanthus affinis* R. A. Dyer. 2. *Cyrtanthus speciosus* R. A. Dyer. 3. *Clivia caulescens* R. A. Dyer. 4. *Cryptostephanus vansonii* Verdoorn; 4a. same, portion of perigone showing paraperigone (corona) lobes and stamens in two series.
Plate 316

branched, and often the leaves die down in winter, leaving the slightly fleshy leaf bases crowning the apex of the semipersistent, variously enlarged stem. The stem dies back very gradually with age and new roots are produced from its side, slightly below the base of the leaves. The storage capacity of the leaf-bases (rudimentary bulb) as compared with that of the old stem varies in different species.

CYBISTETES LONGIFOLIA (L). Milne-Redhead and Schweickerdt, which was so thoroughly reported in Journ. Linn. Soc. (Bot.) 52: 192 (1939) completes Volume 25 on plate 1000. It was stated there that the close similarity in the leaf characters of *Cybistetes longifolia* and *Am-mocharis coranica* is undoubtedly responsible for much of the confusion between the two plants. In their spreading, distichous, biflabellate arrangement, in the dying back from the tip and the lengthening again by further growth from the base in general appearance the leaves are remarkably alike. While the former is restricted to a small area of the South-Western Cape, the latter, though not in that area, extends throughout the rest of South Africa and into adjacent parts of Tropical Africa. Thus there is no possibility of comparing the two plants together in the wild.

After Vol. 25 the publication "Flowering Plants of South Africa" was given the shorter title "Flowering Plants of Africa" (F. P. A.) in order to develop the Pan African ideal in botanical exploration and research. This volume, which completes the series to-date, contains only one species of *Amaryllidaceae*. It is *Gethyllis linearis* L. Bolus. It will do no harm to draw attention once again to the unusual habit of this endemic genus. The leaves are produced after the winter rains begin at the Cape, and disappear or nearly so, by the time the flowers make a very brief appearance during summer. The perianth is long and slender and extends underground to the bulb and it is only in autumn or early winter that the maturing fruits come above ground. There are frequent references to *Gethyllis* in old books on botanical exploration of the Cape Province, since the fruits were much prized. Most of them have a pleasant fruity aroma, and an alcoholic infusion from them was used ostensibly as a remedy for digestive troubles.

"Flowering Plants of Africa" is not the only scientific publication in South Africa in which we find new descriptions and information about *Amaryllidaceae*. There have been several items of recent years in the "Journal of South African Botany", edited by Professor R. H. Compton, Director of the National Botanic Gardens, Kirstenbosch (Cape Town), near the southern extremity of the Union, 999 miles from Pretoria by rail.

In "Journ. S. A. Bot." 10: 1944, Miss Barker described *Hessea chaplinii* and *Strumaria salteri* for the first time. Neither is very large but the latter, as the author points out, has a charming inflorescence of pink flowers. The type specimen, collected by Paymaster Captain T. M. Salter, R. N. (retired) came from Pakhuis Pass in the Clanwillian Division of the Cape Province. The former species is quite small and apparently rare, being recorded only from the Malmsbury Division of the

Cape Province. It is apparently closely related to *Hessea gemmata* Benth.

Two more undescribed species of *Agapanthus* were recorded by F. M. Leighton (Mrs. Isaac) in "Journ. S. A. Bot." 1945, but except to say they are among the smallest in the genus, *A. patens* focussed in the mountains of Basutoland and *A. gracilis* from Zululand, no further details will be given here. Mrs. Isaac's research on the genus has been temporarily interrupted, but it is hoped that she will soon be able to continue and bring up to date her account of the genus in a unified effort.

These, together with a new species of *Boophone*, *B. haemanthoides*, Leighton (Journ. S. A. Bot. 13: 59, 1947), are the chief new records, but there is one more reference which is of particular interest. Dr. Barnard, in "Journ. S. A. Bot." 13: 1 (1947), gives a description of the *Codex Witsenii* in the South African Museum, Cape Town. It concerns the Governor Simon van der Stel's Expedition to Namaqualand 1685-6. The Expedition numbered among its personnel a talented artist who made good paintings of numerous subjects of biological interest. Among the paintings was one of a flowering bulb of a species of *Brunsvigia*. Taking the field notes into consideration, botanists at the Cape arrived at the conclusion that it was probably *B. appendiculata* Leighton. The van der Stel record languished only 260 years without a name.

And this reference to *Brunsvigia* serves to say that the present author is busy on a taxonomic study of the genus as a whole.

STANFORD'S CULTURE OF SOUTH AFRICAN BULBS

As we go to press, the welcome news was received through Mr. Bruce Hinman, Geneva, Illinois, that the publication of Miss K. C. Stanford's long delayed book on the culture of South Africa bulbs is now definitely set for this winter (1948-1949). The publishers are Messrs. Maskew Miller, Adderley Street, Cape Town, South Africa.

We feel that it is particularly appropriate to announce this book in the 2nd SOUTH AFRICAN EDITION of HERBERTIA. We have all been looking forward to the appearance of this book, and feel that it will add greatly to the appreciation of South African bulbous plants, including many beautiful amaryllids.—Editor.

TRAUB & MOLDENKE'S "AMARYLLIDACEAE: TRIBE AMARYLLEAE"¹

This is a taxonomic treatise on the Tribe *Amarylleae* of the *Amaryllidaceae*, including the seven genera, *Lepidopharynx*, *Worsleya*, *Amaryllis* Linn., *Placea*, *Griffinia*, *Ungernia* and *Lycoris*. It includes the detailed descriptions of the species, and if required their grouping into subgenera, under each genus, and the arrangement of the genera under three subtribes.

The three original illustrations of *Amaryllis belladonna* Linn., by Hermann (1698), Merian (1705) and Seba (1734), cited by Linnaeus in "Species Plantarum", 1753, that definitely decide the identity of this species, and illustrations of *Brunsvigia rosea* (Lamarck) Hann., by Ferrari (1633) and Barrelier (1714), the species omitted from "Species Plantarum", 1753, are reproduced. There are also illustrations of *Lepidopharynx deflexa*, *Worsleya Rayneri*, *Amaryllis advena*, *Amaryllis bicolor*, *Amaryllis elegans*, *Amaryllis Leopoldii*, *Placea ornata*, *Griffinia hyacinthina*, *Ungernia Sewerzowii*, *Lycoris Sprengeri*, *Lycoris incarnata*, *Lycoris sanguinea*, *Lycoris radiata* and *Lycoris aurea*.

Although the subject is no longer an academic one since the publication of Uphof's researches (1938, 1940), it is of interest to note that the book also includes, for the sake of completeness, the following important work on nomenclature:—Detailed proofs are presented (a) for the typification of the Linnean species, *Amaryllis belladonna* Linn. 1753 (= the American Belladonna), and the non-Linnean species, *Amaryllis rosea* Lamarck, 1783 (= the Cape Belladonna); and (b) for the typification of the genus *Amaryllis* Linn. 1753 (syn.—*Hippeastrum* Herb. 1821) by Herbert in 1819, and the valid publication of *Coburgia* Herb. 1819 (syn.—*Amaryllis* Herb. 1821, non Linn.). Under the International Rules of Botanical Nomenclature, therefore, (a) on the species level, the epithet "*Belladonna*" is permanently attached to the American Belladonna, and the epithet "*rosea*" can never be separated from the Cape Belladonna; and (b) on the generic level, the name *Amaryllis* Linn. 1753 (syn.—*Hippeastrum* Herb. 1821) must be retained for the American group, and the name *Coburgia* Herb. 1819 (syn.—*Amaryllis* Herb. 1821, non Linn.) applies to the Cape Belladonna. These conclusions are in essential agreement with those previously arrived at by Stapf (1929) and Uphof (1938, 1940, 1948). However, because there are only slight morphological differences between *Coburgia* Herb. (1819), and fertile hybrids can be obtained on crossing the Cape plant with typical species of the genus *Brunsvigia* Heist., Hannibal (1944) had reduced *Coburgia* Herb. (1819), under the synonym, *Callicore* Link, to the synonymy of *Brunsvigia* Heist., and this disposition is accepted by the authors. The typification of the Linnean genus *Amaryllis* Linn., is in harmony with the proposal of Hitchcock (1929), and conservation of any of the affected genera is ruled

¹ "Amaryllidaceae: Tribe Amarylleae" by Hamilton P. Traub and Harold N. Moldenke. The American Plant Life Society, Box 2398, Stanford, Calif. Manila covers; 194 pages; \$4.00, postpaid.

out because it is shown that the case of Linnean genera is already provided for by Article 20 of the Rules, and in addition, more problems would be created than could be solved by such a procedure.

Authors' summary.

NOTES ON AMARYLLIDS IN THE HOLY LAND

Capt. W. F. W. HARDING, *England*

(This article was received too late for inclusion in HERBERTIA, volume 14, 1947 along with the one by Mr. Hardy.—Ed.)

The illustration (Figure 187) of *Vagaria parviflora* shows a specimen



Fig. 187. *Vagaria parviflora* as it grows in its native habitat in Palestine. Photo by W. F. W. Harding.

growing wild on the rocky but afforested (Pine species) slopes in Palestine at Bab el Wad at the gate to the pass into the hills to Jerusalem. The photograph was taken on September 16. Poor rock crevices on dry

hillsides are its favorite haunt, and the bulbs cling very tenaciously to the sides of the crevices in which they grow, about 6 to 9 inches below the surface of the soil. The flower scape is about as tall as those of *Pancratium maritimum* but is more slender and the flowers are only about one-third the size of that species. There is no scent. The parandroecium (staminal cup) is deeply divided.



Fig. 188. *Pancratium maritimum* as it grows in its native habitat in Palestine. Photo by Capt. W. F. W. Harding.

Figure 188 shows a specimen of *Pancratium maritimum* taken on September 14 at Gaza in Palestine on the seaward slopes of the sand dunes that fringe the beach. This seems to be a true marine plant for we found it confined to the dunes that stretch along the coast. The dune sand seems to furnish all of the nourishment that it needs. It is a thing of real beauty and its flowers, borne in an umbel of three to ten on the top of a foot high scape, reminded one superficially of a mixture of a large trumpet daffodil and a Madonna *Lilium*. The perfume is exquisite. The color as in the case of *Vagaria*, is pure white, and again in both cases the leaves succeed the flowers.

CHROMOSOME NUMBERS IN *AMARYLLIS* LINN.

DR. ERNESTO DE MIRANDA NETO, *Agronomist,*
Rio de Janeiro, Brasil

This is a translation of the writer's article (Neto, 1945) published a few years ago. Since this was published, the writer has accepted the correct nomenclature, *Amaryllis* Linn. (1753), (syn.—*Hippeastrum* Herb., 1821) for the American group in accord with Uphof's contributions in *HERBERTIA* 5: 101—109, plates 107 & 108. 1938; *HERBERTIA* 6 (1939): 163—166. 1940; and *HERBERTIA* 13 (1946): 97—98. 1948; and also the disposition of the Cape Belladonna, *Brunsvigia rosea* (Lamarck) Hannibal, as set forth in *HERBERTIA* 9 (1942): 101—102, 146. 1943.

The plants belonging to the genus *Amaryllis* Linn., are frequently found in Brazilian gardens where they are greatly admired and appreciated for their outstanding beautiful flowers. They are also characterized by iridescence of the tepalsegs, and the flowers of some species are delightfully fragrant.

Since Johnson in 1799 produced the first hybrid *Amaryllis* in England, many others have been introduced. Herbert raised thirty-five hybrid *Amaryllis* from 1811 to 1824. From 1830 to 1880 great advances were made in this field by the English firms of Ker and Veitch. In 1928, at the 15th Annual Exhibition sponsored by the United States Department of Agriculture, 1200 specimens of hybrid *Amaryllis* were shown, all distinct.

Heitz (1926) and Inariyama (1937) were the first to investigate the karyology of *Amaryllis* Linn.

Heitz (1926) studied the karyology of *Amaryllis striata* Lamarck var. *fulgida* (Ker-Gawler) Traub & Moldenke (syn.—*Hippeastrum rutilum* var. *fulgidum*), and he reported $2n = 24$ or 22 for this variety. His technique consisted of boiling the root-tips in a solution of acetic-carmin and then crushing them with a needle. This was good work if the date of these experiments is taken into consideration. He did not publish a drawing of the chromosomes.

Inariyama (1937) determined the chromosome complement of one *Amaryllis* species and one hybrid.

Amaryllis vittata L'Hérit. (syn.—*Hippeastrum vittatum* Herb.),
 $2n = 44$

In the diploid complement, the chromosomes are of varying lengths. The constriction is submedian in about 8, subterminal in 28, and quite subterminal or terminal in the rest of the chromosomes. Although an exact study of the chromosome morphology has not been made, the somatic number suggests that the plant is tetraploid with $n = 11$ as the basic number, as shown in Plate 316a, fig. 1. Nagao and Takusagawa (1932) have reported $2n = 46$ for this species, a number which is not exactly four times the basic number, $n = 11$.

Amaryllis hybrida, $2n = 44$

Generally speaking, the somatic chromosome complement of this particular hybrid *Amaryllis* studied by Inariyama (1937) greatly resembles that of *Amaryllis vittata*, as shown in Plate 316a, fig. 2.

MATERIALS AND METHODS

In the case of the present researches, the chromosome complements of three *Amaryllis* species were determined. The material studied was furnished by Professor Honorio da Costa de Monteiro Filho, Botanical Garden of Rio de Janeiro, and by our colleague Helmut Hamacher. The bulbs were grown in soil, and the root-tips, about 5 mm. long, were fixed in Navashin's modified solution, in the following proportions:

Solution A.	Distilled water	70 ml.
	Formalin	30 ml.
Solution B.	Distilled water	92 ml.
	Chromic acid	1 gm.
	Glacial acetic acid	7 ml.
Solution C.	Osmic acid	1% solution

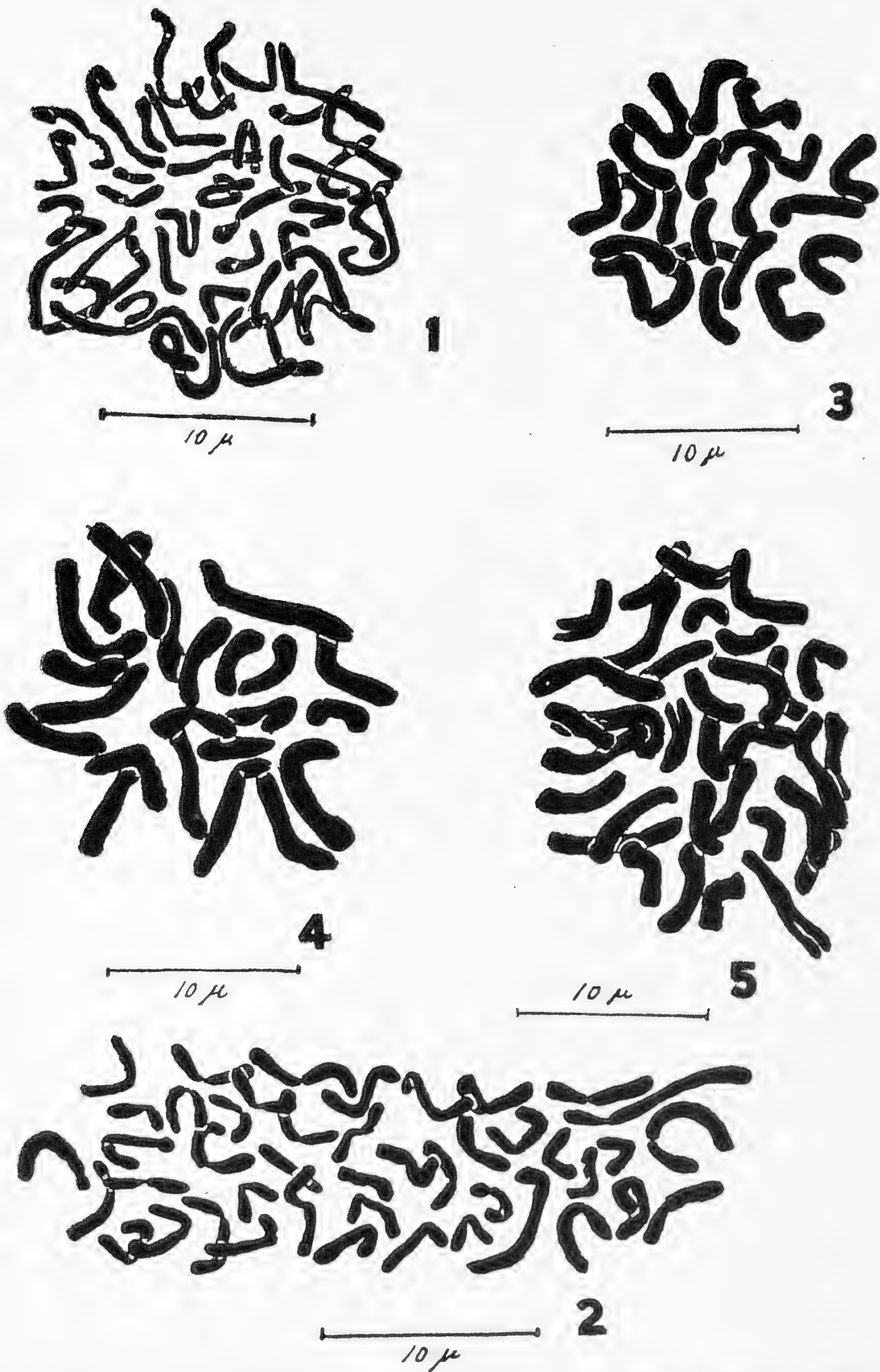
Equal quantities of solutions A & B were mixed immediately before using. Solution C was added at the rate of 1 drop for each milliliter of the A and B mixture.

The material was fixed for four hours, and it was then washed in running water for eight hours. It was then dehydrated by an ethanol series, and followed by a gradual series of ethanol-xylol until pure xylol was reached. The material was then imbedded in paraffin (52° C., M. P.), the oven being regulated at 60° C.

The material was cut to a thickness of 12 microns with a Minot type microtome. Previous study of longi-sections had shown that the size of the cells of the root-tip growth zone varied from 18 to 20 microns.

The sections were placed on slides that had been thinly coated with Mayer's albumen, and were heated at a temperature of 40° C. Paraffin was removed in a series of xylol, xylol-ethanol mixtures until 35% ethanol was reached, allowing 5 minutes in each mixture in the series. The sections, attached to the slides, were then washed in distilled water for 5 minutes, and put in a solution of 4% ferric ammonium sulfate ("iron-alum") for four hours. They were then removed, washed and placed in Heidenhain's iron-haematoxylin for four hours. The sections were differentiated under the microscope in "iron-alum" at 2%. Finally, the sections were dehydrated, beginning with ethanol 35% and ending with pure xylol, and were then mounted in Canada balsam.

Many slides were prepared, and studied under the compound microscope. The chromosomes were observed as somatic metaphases, and were drawn by means of a Zeiss Camera lucida (Abbe type), as shown in Plate 316a, figs. 3, 4 & 5.



Chromosome numbers in *Amaryllis* Linn.—1. *Amaryllis vittata*; 2. *Amaryllis hybrida*; 3. *Amaryllis calyptrata*; 4. *Amaryllis stylosa*; and 5. *Amaryllis Reginae*. 1 and 2 reproduced from Inariyama (1937); 3, 4 and 5 original.
Plate 316a

DETERMINATION OF CHROMOSOME NUMBERS

The three species of *Amaryllis* Linn., included in the study were: *Amaryllis Reginae* Linn., *Amaryllis stylosa* Sweet, and *Amaryllis calyptrata* Ker-Gawler.

Amaryllis calyptrata Ker-Gawler; $2n = 22$

The somatic complement includes chromosomes of various sizes, the ones of medium and small size outnumbering those of double the size of the small ones. The large ones appear to have terminal or subterminal constrictions, and they appear to be of two pairs. We could not determine their number according to the constrictions.

It was concluded that this species had double the basic $n = 11$, or $2n = 22$ chromosomes, as shown in Plate 316a, fig. 3.

Amaryllis stylosa Sweet; $2n = 22$

The chromosome complement of this species is similar to that of *Amaryllis calyptrata*, but the chromosomes appear to be a little smaller, as shown in Plate 316a, fig. 4.

Amaryllis Reginae Linn.; $2n = 33$

The chromosome complement of this species is similar to those of the two preceding species, except that it is a triploid as shown in Plate 316a, fig. 5.

DISCUSSION AND CONCLUSIONS

Heitz (1926) had concluded that the basic chromosome number in *Amaryllis* Linn., was $n = 11$ or 12. Inariyama (1937) later definitely established the basic number for this genus as $n = 11$. This is in harmony with the results presented in this paper which has established the numbers $2n = 22$ for *Amaryllis stylosa* and *Amaryllis calyptrata*, and $2n = 33$ for *Amaryllis Reginae*.

Inariyama (1937) has observed natural hybrids in *Lycoris*, and apparently this is also true in *Amaryllis* Linn., with particular reference to *Amaryllis Reginae*. This species is commonly found in the mountains surrounding Rio de Janeiro (Federal District), and in the sand banks of the "Baixada Fluminense" (low region in Rio de Janeiro State). Prof. Honorio C. Monteiro de Filho had observed that *Amaryllis Reginae* was sterile and this led to the study of the chromosome complement in this species. From the data available, it appears that *Amaryllis Reginae* is a natural hybrid between a species having $2n = 22$, and a second with $2n = 44$. This hypothesis is plausible because in addition to the $2n = 22$ species studied, there are a number of other species, varieties and forms in the same geographical range—*Amaryllis ambigua* Sweet (= *Amaryllis elegans* Sprengel var. *ambigua*), *Amaryllis breviflora* (Herb.) Traub & Uphof, *Amaryllis Gardneri* Seub. (= *Amaryllis organensis* (Hook.) Traub & Uphof), *Amaryllis aulica* Ker-Gawler, *Amaryllis miniata* Sims

(= *Amaryllis striata* Lamarck var. *fulgida*), *Amaryllis glaucescens* Mart. (= *Amaryllis striata* Lamarck), and other varieties of *Amaryllis striata* Lamarck. Among these there may be one or more with $2n = 44$. Our colleague Helmut Hamacher has promised to continue these studies in order to test the proposed hypothesis.

ACKNOWLEDGEMENTS

The work reported was completed in major part while the writer was a student in the Escola Nacional de Agronomia. He is grateful to Professor Honório Monteiro de Filho for advice and help graciously given. He is also indebted to Professor Verlande Duarte Silveira, and Professor Carlos Lacerda for laboratory facilities graciously extended, and to Francisco Amaden for help in the preparation of the material.

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POSTSCRIPTS

POSTSCRIPT.—Our colleague, Dr. Moldenke, and Mrs. Moldenke, delegates representing the New York Botanical Garden at the recent Latin American Botanical Congress, are also on tour. Letters have been received from Dr. Moldenke while in Brazil, Argentina, Venezuela and Chile.

Under date of October 29, from Santiago, Chile, Dr. Moldenke writes, "In northern Argentina I saw amaryllis everywhere. On a mountain outside of Tusumán we passed (in our chartered bus) a meadow of green grass and great colonies of *Amaryllis* in full bloom. There must have been 75 or 100 plants in bloom in a meadow not more than 100 feet square. On the top of the mountain one of our group came to me with a bouquet of probably 40 stalks, each with 3 or 4 flowers open collected a short distance away. The flowers were deep red, while those part way up the mountain were light red or pink. All over here in South America we find the plants cultivated local botanists assure me that they are usually wild plants transplanted to the gardens."

Under date of October 30, he writes, "Santiago Today we went with Drs. Looser, Kausel and Gravdijot on a grand hike up one of the Andes Mountains near here, called Quebrada Ramon. The scenery was grand. At 1000 m., we found *Placea Arzæ* in flower."

November 3, 1948

—Hamilton P. Traub

POSTSCRIPT.—Due to the long delay in the publication of HERBERTIA, Vol. 15, it is possible to report the receipt of GENTES HERBARUM Vol. 8, fasc. 1, May 1949. It contains the news that the correct nomenclature, *Amaryllis belladonna* Linn., and *Brunsvigia rosea* (Lam.) Hann., has been accepted for inclusion in the forthcoming revised edition of the HANDBOOK OF CULTIVATED PLANTS, edited by Dr. L. H. Bailey, of the Bailey Hortorium, Cornell University, Ithaca, New York.

1. SPECIOLOGY

[EVOLUTION, DESCRIPTION, CLASSIFICATION AND PHYLOGENY]

CRINUM OCCIDUALE

R. A. DYER

Crinum occidentale R. A. Dyer, **sp. nov.**, Plate 317.

affinis *C. rautaneniano* Schinz ex descr., floribus paucioribus minoribus perianthii segmentibus dorso rubro suffusis differt.

Bulbus globosus, circiter 5 cm. diametro, in collum breviter productus. *Folia* plus minusve 10, 40—45 cm. longa, 1.5—1.8 cm. lata, canaliculata, patentia, leviter glauca, marginibus minute serratis. *Pedunculus* plus minusve 25 cm. longus, circiter 1 cm. latus, leviter compressus et glaucus. *Flores* 3—4. *Pedicelli* usque 1.5 cm. longi. *Perianthium* 16—17 cm. longum, tubo circiter 9 cm. longo angusto cylindrico curvato, lobis lanceolatis 7—8 cm. longis recurvus dorso rubro suffusis, exterioribus 1.5—1.7 cm. latis, interioribus circiter 2 cm. latis, genitalibus declinatis perianthio leviter brevioribus. *Stylus* leviter exsertus; stigma breviter trilobata. Plate 317.

Distribution:—South West Africa, without exact locality and no record of collector, (communicated by W. M. James) in National Herbarium, Pretoria, No. 28308.

Bulb globose, about 5 cm. in diameter covered by a thin membranous tunic and produced into a short neck. *Leaves* up to about 12, sheathing at the base and shortly continuing the neck of the bulb above ground, the outermost leaves spreading, canaliculate, 40—45 cm. long, 1.5—1.8 cm. broad when flattened, tapering to the apex, the inner leaves progressively smaller in all respects, withering eventually from the tips, slightly glaucous, minutely serrate on the margins. *Peduncle* produced laterally, up to about 25 cm. tall, slightly compressed, 1 cm. in the greater diameter, slightly glaucous. *Umbel* 3—4-flowered, subtended by 2 ovate-lanceolate bracts. *Pedicels* up to 1.5 cm. long. *Ovary* about 1 cm. long. *Perianth* white with a pink stripe down the back of the segments, 16—17 cm. long; tube slender, 9 cm. long, slightly curved and expanding gradually to the throat; segments 7—8 cm. long, recurved in the upper half, the outer 1.5—1.7 cm. broad and cuspidate at apex, the inner 1.9—2 cm. broad. *Stamens* inserted in the throat of the perianth, unequal in length and slightly shorter than the perianth segments; anthers linear, pink, 1.5 cm. long (before dehiscence), black, much contracted and crescent shaped with age. *Style* slender, exserted slightly beyond the filaments; stigma subcapitate and shortly 3-lobed. Plate 317.

The specific epithet indicates its western origin in Southern Africa.

The description of this species is overdue, since it has already come into prominence in cultivation through the activities of Mr. W. M. James.

Evidence of this is to be found in HERBERTIA 8: 43 (1941) 1942. One of the bulbs, originally from South West Africa, was forwarded to me for identification by Mr. James in 1937. The accompanying figure is from a photograph taken when the plant first flowered here in 1939, and differs very little from the inflorescence produced in December-January, 1947-48. It compares closely also with the illustration in the note by Mr. James.

Efforts to identify the plant positively with an established species have failed, and unfortunately efforts to localise it in the wild state in South West Africa failed also. However, the increased publicity it will now receive through the pages of HERBERTIA may result in further information becoming available.

Judging from the type description of *C. rautanenianum* Schinz, from Amboland (which is a northern strip of South West Africa), this species is the nearest relative to our plant. Judging also from Baker's account in Fl. Trop. Afr. 7:402 (1898), it seems that *C. rautanenianum* has somewhat larger umbels and flowers, the latter being white without a pink stripe down the back of the segments and the segments are apparently broader and more contracted to the base than in *C. occiduale*.

Mr. James makes mention of his observations on pollen dehiscence. As far as my limited experience with *Crinum* goes, it is not exceptional for the pollen to begin falling shortly prior to the normal opening of the bud in the late afternoon and dehiscence is mainly complete before the following morning. The rapid shrivelling of the anthers on dehiscence makes it important to state in descriptions whether measurements of anthers are made before or after dehiscence. The colour and shape of anthers before and after dehiscence are characters of specific importance in certain cases.

A study of the South African species of *Crinum* is in progress at the National Herbarium, Pretoria, by Miss Verdoorn. As so frequently happens, this project is seriously hampered by imperfect early records and the tangled state of the nomenclature. In the present study too, administrative and other duties cause long and recurring interruptions, nevertheless it is hoped to bring greater order into the genus in South Africa before long.

NORTHERN NEW YORK DAYLILY EVALUATIONS

STANLEY E. SAXTON, *New York*

During the past year my daylily plantings have greatly expanded. At Saratoga Springs, N. Y., there are now three large gardens in different locations. At Mount Arab, in the northern Adirondacks, I now have two different gardens. Almost all of the new daylilies are represented in these gardens, and while I could not see every garden each day, frequent trips between them gave me a well rounded picture of the daylily display.

In this resumé I may mention certain varieties which were favorites with me. This does not indicate that I think these should be rated the



Crinum occidentale R. A. Dyer, *sp. nov.*

Photo by H. King

best in their particular sections. Indeed I believe there is room in the garden world for plants of similar character if at the same time they also have some contrasting growth factor which admits of differing garden effects. I should like to illustrate this point with a discussion of three rose toned daylilies.

Rose Gem (Stout), Martha Washington (Wheeler), and my own Myrna all gave me good performance this summer. Rose Gem and Martha Washington are very nearly the same color,—a bright old rose; Myrna (Figure 189) is a bit deeper in tone. Rose Gem was the tallest of the three, almost four feet. The flower was also the largest, graceful in a somewhat loose petaled effect, with good stem branching and about 25 blooms per stalk. The stems with me were somewhat arching and required staking. Rose Gem is definitely a background plant but bold and showy. Martha Washington was the shortest, about thirty inches tall, a much trimmer flower, more symmetrical and the tepalsegs wider in proportion to the size of the flower which is about four inches. I have observed as many as sixty-six buds on one stem of Martha Washington which is quite definitely a multiflora type. This is a foreground plant. Myrna is in between these two in both height and size of flower. The flower has broad tepalsegs but is differently shaped than the other two. The stems are somewhat arching but do not need staking. Each of these flowers is very lovely, and although the color is similar each fills a different place in the scheme of the flower border.

In the deep purple-red and wine tones my garden had fine bloom on Persian Princess and Purple Finch (Nesmith); Royal Lady and Sabrina (Wheeler); San Juan (Traub); and Royal Beauty (Taylor). Persian Princess and Royal Beauty were the darkest colors, both robust plants with large well formed flowers. Persian Princess is a more velvety color and gave an impression of greater color depth, while Royal Beauty had a satiny sheen and more blue in the color tone. Purple Finch and Royal Lady had the luminous red-purple which one associates with pansy purple. The flowers of Purple Finch seemed small for the height of the stem while the lower stalk of Royal Lady balanced its medium size flowers nicely. The latter was almost a self as it bloomed for me this summer but its form is very different and dainty.

San Juan is a claret-red, tall with medium size flowers but extremely brilliant and with excellent branching. Sabrina shows bronzy tones mixed with the maroon-purple base and is influenced from day to day according to the degree of heat and amount of moisture, sometimes being almost pure bronze.

The above were my favorites in the deeper shades but I should also mention Wolof (Stout), which bloomed very late for me in August and September, and Duncan (Wheeler) which seems a larger and earlier Vulcan.

There are a few fine daylilies which fall into the so-called 'mahogany' range. Brackel (Wheeler) is the showiest, its large flowers being broadly marked with garnet on a mahogany-brown background. Also its tone changes from day to day—some days it is almost a tan with

brown markings. A flower I found to be most consistent both in Saratoga Springs and Mt. Arab was Dr. Traub's Granada. It is a very rich velvety mahogany.

True pinks are still hard to find. Qualifications must be added to the descriptions of these. I am very fond of Bertrand Farr (Stout) and



Fig. 189. Hybrid Daylily—Myrna. Photo by Stanley E. Saxton

Paul Ihrig (Wheeler) which I would call flesh or pastel pink. Georgia (Stout) probably falls in this class but it did not perform well in any of my gardens. I like Bertrand Farr much better. I have a flower from Mrs. Nesmith which I believe is Dresden China, a bi-tone with pastel pink petals, very wide and lightly recurved, and lighter sepals. The form is lovely and it is one of my favorites.

A shade deeper with more salmon in the pink are Piquant (Nesmith), tall and nicely formed although only medium in size; and Miss Houston (Russell) which I did not like as well although it is very similar to Piquant. There are many flowers in this shade now.

Pink Charm (Nesmith) is attractive for its beautifully recurved form and large size, but ochre-red describes the color much better than pink. Highland Chieftain (Nesmith) is a lavender-rose of most unusual shade. I have nothing else like it. Hazel Sawyer (Wheeler) and Dolly Varden (Nesmith) are a dusty pink of similar color tone, the latter being taller.

I have seen some real pink tones in seedlings but they will be rare for some time.

Orange-scarlet and scarlet-red shades, sometimes called raspberry, are stunning in the garden and real eye openers. Red Bird (Stout) should probably be the type flower for this color section. Scarlet Sunset (Wheeler) is a brilliantly glowing color, more orange than Red Bird. The tepalsegs are narrow and the form starlike with muchly recurved tepalsegs. I named two flowers in this color section this year, both with wide petepalsegs. Cotillion was the brightest flower in my garden as long as it was in bloom. Griselle is a raspberry toned flower. Matador (Nesmith) has these bright colors with a tall, well branched and imposing stalk. I wonder why Rajah (Stout) has not received more praise for its rich glowing color?

And the reds! What an array of bright colors. Sachem, Ohred Baronet, Wekiwa, Kanapaha, Berwyn, Royal Ruby and Ruby Supreme. All exciting in one way or another. Kanapaha (Watkins) was a lighter color than the others with me but a clear velvety red. Ruby Supreme (Wheeler) was the largest flower of all with a garnet shading in the red. Baronet (Stout), Berwyn (Traub) and Royal Ruby (Nesmith) were all about two feet tall but all very good velvety reds with Baronet the finest formed flower. Sachem (Stout) and Ohred (Wheeler) are taller and much alike in my garden. Dr. Stout's new early-flowering reds, Caprice and Blanche Hooker, were the first red-toned daylilies to open in my garden. In fact Caprice was the first of all. The color does not compare with the later red sorts, and both are low growing, but they have a place as contrast to the early yellows. I like Caprice the better.

The Sass yellows dominated this section in my garden in 1948. Hesperus gave a fine show with its wide candelaburm branching. Star of Gold was a very pure, large medium yellow while White Lady and Sunny West shared honors in pale yellow. Actually it seems to me that the daylilies nearest to white are not the light yellows but rather the buff or light flesh and cream flowers. Here Duchess of Windsor (Traub) and Easter Morn (Wheeler) stand out for wide rounded petepalsegs and fine form. Another very light flower which I like is Nesmith's China Seas.

Some very nice bicolors among my own seedlings have made me critical of this group. I like Mrs. Nesmith's Bold Courtier, which is large and bold in form, much better than her Gay Troubadour. Stout's

Festival has never grown or flowered well for me while Caballero I like very much. Wheeler's Bobolink grows well but has much shading on the sepals which detracts from the bicolor effect. On the other hand, his Empress, a near self in Florida, is the most contrasty purple and yellow bicolor I have in the garden. I have a few Wheeler seedlings in my test plot which are very lovely in bicolor and bi-tone patterns. My own Saratoga was named not primarily for the bicolor characteristic but rather for its fine form, large size and noble carriage.

If I have neglected to discuss some of the more worthy new varieties it is because I do not have them, have not seen them, or my plants have not fully acclimated themselves to my conditions. I know there are some lovely new orange daylilies around the corner and when I can grow them side by side I will try to compare them. I do want to say that my growing conditions are extremely trying and anything that will stand up and perform well here certainly has merit. Each year I hope to add the newest and best things so that I may better know what is really worthwhile and can, perhaps, help someone else—with growing conditions similar to mine—save much valuable time and energy in finding what will make his garden a more lovely place.

MY BEST DAYLILIES

GEORGE GILMER, *Virginia*

I have been growing *Hemerocallis* for over fifteen years. I see very little of them before 5:00 in the afternoon so any plant that fades is practically worthless to me. I like neat grounds so I am apt to get rid of any plant that has poor foliage.

My garden is about one hundred miles southwest of Washington, D. C. in the eastern foothills of the Blue Ridge. My soil is heavy clay to which I have added considerable humus. We generally have a fair amount of rain throughout the growing season. I try to water my small plants once a week in dry seasons. This is not to keep them alive but to make them grow better.

I have no plants of any kind for sale. I have grown well over three hundred of what I acquired as the best available varieties. About one hundred have been discontinued. Some twenty-five more will be dropped this year.

If you have a favorite not on my list just remember I do not even *hope* to get all of the good new ones. If some I rate "A" are surpassed by those in your garden, it may be because I have not seen your best varieties. Within the next ten years I think most of those rated "A" will be surpassed and many of them will be no longer worth growing. There is also a difference in performance of the same daylily in different climates and under different growing conditions. I rarely judge one until I have grown it for two or three years.

"A" means with me that the plant has no serious defect at any season and is unsurpassed by any I have in the same color blooming at

the same season. "B" generally means one that used to rate "A" but is now surpassed. Occasionally "B" means one with a defect. "T" means I must observe it as a more mature plant for a longer time before passing judgment. Illustration—I used to rate Gold Dust "A." It is now surpassed by Elizabeth and I have reduced it to "B."

A	B	T
Adventure (large flower of gold on tall stalks—vigorous)	Aladdin (poor foliage)	Adiago
Annis Victoria Russell (good yellow)	Afterglow (fades)	August Orange
August Pioneer (good, late)	Apricot (not a dependable bloomer)	Aurantiaca
Berwyn (excellent bright red later than most reds)	Autumn Prince (very late but otherwise poor)	Aztec Gold (should rate A in 1949)
Black Prince (dark red)	Bagdad	Baggette
Caballero (one of the best bicolors)	Baronet (not dependable)	Betty (think it will rate A in 1949, early)
Carl Betscher (largest very early)	Bertram H. Farr (good pink color but fades)	Bicolor
Carnival	Boutonnaire (small, fades)	Black Hills
Chengtu (late and different)	Cinnabar	B Ladham
Colonel Besley (good, late)	Circe	Blanche Hooker
Dauntless	Clarice (expect to discontinue)	Bold Commander
Dawn O' Day	Colleena	Bold Courtier
Doctor Stout (an orange blend, one of the best)	Corinne Robinson	Bright Eye
Dorothy McDade (good, late)	Dawn O' Day	California
Duchess of Windsor	Dominion (dull red)	Cheerio
Elizabeth (very early and good)	Elaine (nearly a fadeless pink)	Chrome Orange
Fire Red	El Capitan	Clarion (would be A clear pink if it did not fade and close early)
Fred Howard	Emberglow (nearly a fadeless pink)	Confucius
General MacArthur (no better red)	Evangeline	Damozel
George Kelso	Flava	Dawn Play
Georgia (excellent)	Fulva Maculata	Decoration
Golden Orchid	Festival	Debonair
Granada	Genevieve	Dorothy Dawn
Hankow (late)	Gold Dust (very early)	Dragon
Helen Wheeler (no real pink fades less)	Gold Empire	Ducat (expect it to rate A in 1949)
Inca Gold	Golden Fleece	Earlianna (should rate A in 1949)
Indian Chief	Honey Red Head	Early Bird
Lidice (brilliant orange)	Joy Russell	Enchantress
Massasoit (tallest, red)	Kwanso fl. pl.	Fantasia
Matador	Lamar Russell	Garden Lady
Mayor Starzynski	La Tulipe	Gay Troubador
	Linda	Grosbeak
	Lustrious	Havilah
	Majestic (almost A)	Helicon
	Malcolm Russell	Hesperides (should rate A in 1949)
	Midas	Hesperus
	Mikado	Isaac Newton
		Jessie Newhall
		John Blaser
		J. S. Gaynor
		Judge Orr
		Kanapaha
		Kinglet

A

(blooms over a long season)
 Mexico
 Mount Vernon
 Mrs. B. F. Bonner
 (good yellow)
 Mykawa
 (good dark red)
 Patricia
 (lovely yellow)
 Pink Charm
 Portia
 (take this rating with grain of salt—my son's seedling)
 Purple Waters
 (not a blue purple but the best I have in purple)
 Queen of Gonzales
 Queen Wilhemina
 Rajah
 Rancho Diana
 (small)
 Reba Cooper
 Revoloute
 (excellent)
 Rose Gem
 (Wau Bun type)
 Ruby Supreme
 (excellent)
 San Juan
 (good red)
 Santa Maria
 (bicolor)
 Stalwart
 (old but good)
 Sylvia
 Symphony
 Taruga
 (light yellow with form of Wau Bun)
 Theodore Mead
 (orange with form of Wau Bun, fine)
 Victory Montevideo
 War Path
 (good red)
 Wau Bun
 (fine)
 Wekiwa
 (red, lovely in evening sun)
 Wolof

B

Mildred Orpet
 Minnie
 (would rate A if pigmentation not uncertain)
 Miss Welder
 Mount Vernon
 Now Glory
 Ophir
 (for years one of the best)
 Peony Red
 (would rate A if held up better in late afternoon, very distinctive color)
 Port
 Princess
 Queen of Monterey
 Red Bird
 (deteriorates some in late afternoon)
 Rosalind
 (wonderful pink color but fades some and poor foliage)
 Royalty
 (poor foliage)
 Russell Wolfe
 Sachem
 (almost A)
 Saturn
 (poor foliage)
 Serenade
 Sonny
 Soudan
 Spitfire
 (poor foliage)
 Spring Delight
 Sweetbriar
 (good pink but fades some)
 Tara
 (good but fades some)
 Tejas
 (poor foliage)
 Theron
 (fades and poor foliage but good color in morning)
 Vivosso
 (almost A)
 Vulcan
 (fades and curls in late afternoon)

T

Luna Goddess
 Manchu
 (fades)
 Margaret
 Margaret Palmer
 Margaret Stuntz
 Meteor
 Mexia
 Mignon
 (small)
 Mission Bells
 Miss Jennie
 Modesty
 Monterey
 Mrs. John J. Tigert
 (expect to rate A in 1949)
 Mrs. Jones
 Musette
 Ningpo
 Ortencia
 Paladin
 Pasgagoula
 Pheonecia
 Pierre Sue
 Play Time
 Plume Rouge
 Pride of Houston
 Queen Mary
 Red Cap
 Red Gem
 Red Imp
 (may grade A in 1949)
 Richard
 Rocket
 expect to rate A in 1949)
 Roger Bacon
 Santa Lucia
 Seminole Chief
 (fades)
 Semperflorens
 (good)
 Silver Star
 (good)
 Sulen
 Sun Gold
 Sunkist
 Viking
 (should rate A in 1949)
 Vivian Toole

MY BEST 25 DAYLILIES

ELIZABETH LAWRENCE, *North Carolina*

It takes about three seasons to evaluate a daylily. At first you consider the individual flower, its size, form, substance, pattern and color. Later you take into account the mass effect of the clump, the season and length of bloom, and the general garden value. When you consider the effect of the clone in the garden, the size and pattern of the individual flower are no longer important. The clone, Dr. Stout, which I did not fully appreciate at first, has grown in its third year to such a fine strong floriferous clump, and has bloomed so gayly for so long, that I now rate it with Carnival as one of the finest.

When you consider bloom in the border over a long period, the early and late varieties become more important, in spite of their faults, than fine midseason varieties of which there are so many. Daylilies take up a lot of space. In order to have a long season of bloom in a fairly small garden one must eliminate fine midseason clones, and choose instead less beautiful ones that bloom early and late in the season. The earliest in my garden bloom in April. In this season I have been able to find no greater variety than the pale yellow of *Hemerocallis Dumortieri*, and the deep orange yellow of Dr. Regel. For the late ones, there is more variety, but still not enough. There is continuous bloom from early April to the end of July, but the July bloomers are comparatively few, and in August in my garden, only Boutonniere is left. It is not really a very good daylily. The stems are weak, and the flowers small and a poor color, and yet I would not be without it because of its late bloom.

MY 25 BEST DAYLILIES

Early (April)	Early Mid-season (May)	Mid-Season (June)	Late (late June & July)
I. My 15 Best Daylilies			
1. Dumortieri (Y)	2. Mikado (Ed)	5. Carnival (P)	14. Dorothy Mc-
	3. Queen of May	6. Iowa (LY)	Dade (Y)
	(OY)	7. Fire Red (R)	15. Boutonniere
	4. Lidice (O)	8. Mrs. B. F.	
		Bonner (Y)	
		9. Ophir (O)	
		10. Golden Dream	
		(O)	
		11. J. A. Crawford	
		(Y)	
		12. Dr. Stout (B)	
		13. Victory Taier-	
		hchwang (R)	
II. Next 10 Best			
16. Dr. Regel (O)	17. Victory Mon-	20. Berwyn (R)	24. Potentate
	tevideo (R)	21. Goldeni (O)	(Pur.)
	18. Mayor Star-	22. Starlight (LY)	25. Chandra (Y)
	zynski (B)	23. Tejas (R)	
	19. Queen Wil-		
	helmina		

REPORTS FROM REGIONAL DAYLILY TRIAL GARDENS

[Reports from a number of Regional Daylily Trial Gardens have been received, and are reproduced below.]

1. DAYLILY TRIALS AT GREENWOOD PARK

PAUL L. SANDAHL, *Supt.*,
Des Moines, Iowa, Park Board

(See Plate 318)

The newer things (anyway the new ones to us) are too young yet for full judgment, some of them have not even bloomed as yet. Among them however, which have made a showing is Reinbeck. Outstanding for strength, it is tall and beautiful. The main tone of its large flowers is straw or cream color to light yellow with the most dainty flush of maroon as if some phantom painter had touched each petal with a dry brush. It is floriferous, several blooms out at the same time, and has sweet fragrance. Papagaio is shorter—to about two feet—very strong and is showy out of doors with its red, orange red, and vermillion. Iowa shows up well out of doors. It is clear light yellow with stippled texture and full broad flowers, and is shorter than Reinbeck.

Actions of the general public so often unpredictable are sometimes seemingly unreasoning. Certain individuals, and not a large number of them, are very much interested in hemerocallis and know and grow the best varieties are always willing to discard any of them for a better variety. They are the ones who I think will carry the hemerocallis interest and advancement on through the years. A little larger proportion of the general public like to have those brilliant or dainty spots in their garden at this time of year that can be obtained only with hemerocallis. They don't care what the name is just so its hemerocallis and one the neighbors don't have. Then the big majority pass by within a few feet of the most beautiful creation of its class without notice because they seem to think (and some of them say it) "there's that corn lily we used to have out on the farm," or "Mother used to have some of those lemon lilies right by the well." More time for general education, and a lot of elimination of similar varieties no doubt will help to get discriminating interest of the large majority of the people.

The best 25 clones of those tested for at least three years, are as follows:

Hyperion	San Juan	J. A. Crawford
Pale Moon	Fire Red	Reba Cooper
Mrs. John Tigert	Peony Red	Mayor Starzynski
George Kelso	Duchess of Windsor	Helen Wheeler
Granada	Carnival	Florham
Theodore Mead	Osceola	Dr. Regel

La Tulipe	Amaryllis	Dr. Stout
Lidice	<i>H. fulva</i>	
Mikado	Lemoni	

Of course when some of the newer ones prove themselves a little farther we certainly will place them at the head of this list. It is always difficult to specify a list like this and often brings deep chagrin to the one who does it, because the question is always asked, "well what's the matter with the following?"

Bijou	Burmah	Mildred Orpet
Goldeni	E. A. Bowles	Estelle Friend
Bay State	Woodlot Gold	Elaine
Mrs. Wyman	Ember Glow	The Gem
Yellow Hammer	John Blaser	George Yeld
Harvest Moon	Rouge Vermilion	

The answer must ever be that it depends on who was the judge or the narrator.

The following have disappeared from the garden.

Adventure	Vesta	Victory Taierhchwang
August Pioneer	Vulcan	Autumn Prince
Circe	Anna Betscher	Gold Dust
Gracilis	Craemore Henna	Victory Montevideo
Rajah	Golden Mantle	Waubun
Soudan	Queen Mary	

Some might have been appropriated by a ravenous admirer, and some might have died from no reason chargeable to themselves. However, we have simply replaced those that disappeared with another variety which we had at hand. It may be that a second trial might prove some or all of them to be first class.

The following are all medium to strong growers which include some that have a tendency for the foliage to yellow. This sets them back a little each year so that they about hold their own. We do not know the cause nor the remedy for it.

Norcensis	Peony Red	Miranda
Harvest Moon	Elaine	Cressida
Lovett's Lemon	Araby	Fred Howard
Shirley	Domestico	Emily Hume

Sir Michael Foster is weakest live one we have.

All other varieties in the garden are rather uniform in their hardiness and strength of growth, producing full healthy plants and abundant blooms.



Greenwood Park, Des Moines, Iowa, showing two portions of the hybrid *Hemerocallis* Test Gardens.

2. DAYLILY ADAPTABILITY TESTS AT COLLEGE STATION, TEXAS

H. T. BLACKHURST, *Horticulturist*

Department of Horticulture, Texas Agricultural Experiment Station, College Station, Texas

During the last five years some two hundred daylily clones have been under observation at College Station. Of this number perhaps twenty-five or thirty might be considered very well adapted while a number of others have shown characteristics of sufficient merit to warrant culture where particular attention can be given to their care.

For purposes of rating, characters have been judged under eight categories each having an assigned value and the eight values making a total of 100 points. When all observations are made and notes collected, the values are totaled and the sum used as the basis for rating clones. This is a very severe score card which is used to obtain the relative position of each clone.

Flower color and texture have been given a total value of 35 points, flower form and scope each 15 points, flower durability and plant vigor 10 points each, flower size 8 points, foliage 5 and flower odor 2 points.

No attention has been given to the use of the clones in landscape design since the purpose is only to test them for adaptability to the conditions of this area. Since all have been grown under open field conditions without irrigation, the results have perhaps failed to isolate some desirable varieties that could be used successfully under home garden conditions. The tests have, however, shown that the daylily is a hardy grower and could be used successfully and advantageously in the home flower garden.

Table 1, lists the best thirty clones thus far tested in order of their score. Not all point scores are given, only those being included that are of outstanding interest. All categories are, however, included in the over all rating. It should be noted that these relative numerical ratings are not directly comparable with those obtained by using the OFFICIAL SCORE CARD of THE AMERICAN PLANT LIFE SOCIETY. Therefore, the final ratings, A, outstanding in adaptability, and B, very well adapted, under the conditions of the tests, are given in the last column of the table for ready reference by the amateur.

Conclusions: Results of the daylily adaptability tests point to the flower as a very hardy yet attractive one for use in landscape design or the home flower garden. The daylily is able to withstand the hot, dry summers and still produce a profusion of bloom in the spring and fall season. It is hoped that more emphasis will be placed on this flower and that the future will see it more freely used around the home.

Table 1. Relative and final ratings of the thirty best daylilies tested for adaptibility at College Station, Texas, under open field conditions without irrigation. It should be noted that this is a very severe test, and that the score card also was very severe.

Variety	Plant Vigor	Scope		Flower		Color Purity	First Bloom	Relative Rating ⁴	Final Rating ⁵
		Height	Desirability	Size	Durability				
Dauntless	7	2-3	8	med.	9	26	5-21	88	A
Domestico	8	1-2	10	small	7	28	3-16	86	A
Eldorado	9	3-5	9	med.	5	25	5-12	82	A
Tangerine	7	1	8	small	10	30	3-28	82	A
San Juan	4	2-3	9	med.	10	30	5-17	81	A
Harvest Moon	8	2-3	9	med.	5	28	5-11	80	A
Michael Foster	7	3-5	9	med.	9	20	5-15	80	A
Pale Moon	9	2-3	8	med.	7	25	5-18	80	A
Queen of May ¹	7	2-3	8	med.	8	25	4-30	78	B
Lidice	8	2-3	8	med.	8	20	5-12	77	B
Ophir	8	2-3	8	med.	5	25	5-18	77	B
Burmah	7	2-3	8	large	8	25	5-24	76	B
Cinnabar	9	2-3	8	med.	7	20	5-12	76	B
Queen of May ²	6	2-3	8	med.	8	25	4-9	76	B
Burbank	8	3-5	7	med.	7	25	4-26	75	B
Queen of May ³	9	3-5	8	med.	5	25	5-14	75	B
Emily Hume	5	2-3	8	large	7	28	5-12	74	B
Helen Wheeler	10	1-2	8	med.	8	20	5-10	74	B
Peony Red	4	2-3	8	med.	8	30	5-17	74	B
John Blaser	6	2-3	8	med.	7	25	5-13	73	B
Queen Wilhelmina	8	3-5	8	med.	9	20	5-12	73	B
Indian Chief	2	2-3	8	med.	7	30	5-18	72	B
Hyperion	2	2-3	8	large	8	25	5-15	71	B
Estelle Friend	6	2-3	8	med.	7	22	5-12	70	B
Marconi	5	2-3	7	small	10	20	5-13	70	B
Mayor Starzynski	7	2-3	9	med.	5	20	5-15	70	B
Mikado	8	2-3	8	large	7	20	4-22	70	B
Mrs. John J. Tigert	6	2-3	8	large	8	25	5-2	70	B
Spartan	7	2-3	8	med.	3	25	4-9	70	B
Victory Taierhchwang	4	2-3	8	med.	8	21	5-24	70	B

¹ From Univ. of Fla.

² From The American Plant Life Society.

³ From H. M. Russell, Spring, Texas.

⁴ The relative ratings for adaptibility are based on a very severe score card and these numerical ratings are to be considered only from the standpoint of the relative position of the clones. For final ratings see next column.

⁵ The final ratings, **A**, **outstanding in adaptability**, and **B**, **very well adapted**, are comparable with similar **A** and **B** ratings by amateurs, and are to be used to characterize these clones for adaptability to the severe conditions of the tests.

3. DAYLILIES AT WHITNALL PARK

JOHN E. VOIGHT, *Acting Supt.*,
Botanical Gardens, Hales Corners, Wisconsin

In our 1947 progress report, we mentioned plans for revising our entire *Hemerocallis* collection, and we are pleased to report that this was accomplished this past spring. Due to the lifting, dividing and resetting of the plants, naturally the growth has been retarded and the performance has not been up to normal this season. However, on the basis of past observations of the entire collection, we feel that the 38 clones included in Table 1 are tops from the standpoint of color, size, length of blooming season, foliage, sturdiness of stems, and effectiveness in the landscape.

Table 1. List of 38 best *Hemerocallis* clones at Whitnall Park as of 1948.

Autumn Prince	Eldorado	San Juan
Bagdad	Fire Red	Senator Andrews
Baronet	Fulva Cypriana	Serenade
Buckeye	Goldeni	Sir Michael Foster
Carnival	Helen Wheeler	Theodore Mead
Cinnabar	Hyperion	Theron
Circe	La Tulipe	Triumph
Craemore Ruby	Marconi	Victory Taierhchwang
Cressida	Mrs. John Tigert	Wekiwa
D. D. Wyman	Mrs. W. H. Wyman	Yellow Hammer
Dr. Stout	Pale Moon	Zouave
Duchess of Windsor	Peony Red	
"Dwarf Yellow" (not dwarf)	Royal	
	Russell Wolfe	

We note with great pleasure the ever increasing interest in the daylily collection here at the Botanical Gardens. The entire collection is now concentrated in one area, creating a picture with no end of beauty. The present mass planting of daylilies is backed by commanding giant varieties of delphiniums in conjunction with an interesting background collection of trees and shrubs. The brilliant daylily and delphinium flowers gives a dominating interest to the recess in which they are set.

Acknowledgement of gratitude is due to the hybridizers for having made available this most interesting collection. With their cooperation it has been possible to bring together a vast amount of material in compact arrangement for comparative study, and at the same time to add immeasurable beauty and interest to the collection here at the Botanical Gardens, Whitnall Park.

4. HEMEROCALLIS FOR NORTHERN FLORIDA

JOHN V. WATKINS, *Assoc. Prof. Hort.,
University of Florida, Gainesville*

Today there are some 3,000 varieties of Hemerocallis. From such an imposing list, how shall we appraise clones for Florida conditions? Many are highly touted varieties that are given places of prominence and the advantage of color plates in widely circulated catalogs; others, perhaps, are worthy garden plants though less well known because of restricted regional distribution and little or no advertising.

Trial is the only possible answer. Trial, alongside other daylilies, under normal gardening conditions over several seasons, and then fair and impersonal rating by experienced gardeners. In appraising daylily seedlings, one must have the background of having viewed large numbers of standard varieties already in commerce, because it is well known that types appear in every group of seedlings, that are close approaches to existing clones. Segregation of characters in seedlings of complex lineage accounts for this widely accepted fact.

On the campus of the University of Florida is located one of the Regional Test Gardens for Hemerocallis. Here are received for trial, seedlings from the breeding plots of some of the nation's leading hybridizers; here too are grown many new and old commercial varieties.

For a dozen years this garden has witnessed the passing parade of many different daylilies. Old European varieties, species from the Orient, and brand new seedlings from the plots of the nation's leading hybridizers have grown side by side. Usually, each introduction is kept for three years, during which time notes and observations are taken on the characters noted below. These notes become a part of the permanent record of the project and are later used in arriving at the numerical ratings. Strongly influencing these ratings are remarks and opinions of the Hemerocallis fanciers who visit the campus from time to time. While the ratings are solely the writer's, they can well be considered consensus because they are so strongly influenced by the reactions of our visitors as they view the clones in flower. It should be noted here that the ratings are very close to those published by two Hemerocallis specialists in Orlando.

The following characteristics are used as a basis for the numerical ratings:

VIGOR—Rapid growth under Florida conditions is of greatest importance

FOLIAGE—A mound of evergreen foliage for year-round garden value.

SCAPE—The flower stem should be stout, four-branched and floriferous.

FLOWER—Distinctiveness, shape, form, size, color, texture, durability in the Florida sun, and fragrance are considered carefully.

In Table 1 are listed 32 clones which have received a rating of 9.1 or above. While this list contains only 1% of the clones in commerce,

these are the ones which have rated highest through the years. In all probability a favorite of yours has been omitted, and possibly you consider our rating for a given clone much too high, another too low. For this we beg remission. Perhaps we have not received for trial a clone in which you are particularly interested. Maybe its rating will appear in a future list. Daylily selections rating below 9.1 are listed in Table 2.

Table 1. RATINGS OF DAYLILIES AS GARDEN PLANTS IN
NORTHERN FLORIDA

VARIETY	COLOR	RATING*	REMARKS
AURANTIACA	orange	9.9	This is our best species.
AUREOLE	yellow	9.9	Rated thus for its extreme earliness.
DAUNTLESS	yellow	9.9	Full flower, heavy texture.
EMILY HUME	yellow	9.9	Robust grower, free bloomer.
HYPERION	lime yellow	9.9	A national favorite.
MIKADO	yellow, dark eye	9.9	Still the best eyed type.
PATRICIA	lime yellow	9.9	Popular because of its fragrance.
SEMPERFLORENS	yellow	9.9	Rated tops because of its earliness.
WAU BUN	yellow	9.9	Medium stature, beautiful form.
SAN JUAN	wine red	9.8	One of the best deep reds.
SWAN	canary yellow	9.7	The largest daylily we grow.
BAGDAD	orange and brown	9.7	Good grower, floriferous.
MILDRED ORPET	pastel bicolor	9.7	Distinctive and charming.
KANAPAHA	rose luster	9.6	Appears on many national lists.
BARONET	Brazil red	9.6	One of the earliest reds.
RUBY SUPREME	ruby red	9.6	Large, well branched deep red.
CABALLERO	bicolor	9.6	The writer's favorite bicolor.
MINOR	yellow	9.6	The best dwarf species.
BICOLOR	bicolor	9.5	Dwarf companion for CABALLERO.
SACHEM	wine red	9.6	Top red from N. Y. Botanic Garden.
B. H. FARR	grenadine pink	9.6	First of the near-pinks.
TARUGA	lime yellow	9.7	Popular large yellow dusty tawny.
CLUNY BROWN	pastel bicolor	9.5	Distinctive Florida origination.
DUNCAN	maroon red	9.5	Earliest dark red from Wheeler.
ROYAL RUBY	ruby red	9.5	Top red from New England.
WOLOF	deep red	9.4	Very late red, robust grower in Florida.
GANYMEDE	pastel bicolor	9.4	A distinctive Wheeler origination.
MARCELLE	orange and brown	9.1	Excellent grower, early bloomer.
AMHERST	wine purple	9.1	A new color break.
BLACK FALCON	mulberry fruit	9.1	One of the darkest Hemerocallis.
INDIAN CHIEF	red	9.1	An excellent Florida red.
BOBOLINK	purple and gold	9.1	Sprightly, unusual, floriferous.
BRACKEL	netted brown	9.1	Entirely distinctive Hemerocallis.

* These ratings are taken from articles by this writer. 9.6-9.9—Excellent. 9.1-9.5—Very Good. —J. V. Watkins.

Table 2. Additional Hemerocallis selections for northern Florida, John V. Watkins, 1948.

Ajax	Halo	Rose Gem
Allapattah	Killarney Lass	Royal
Carnival	Lady Franklin	Royalty
Chisca	Mayor Starzynski	Serenade
Chrome Orange	Merry Mood	Sir Michael Foster
Daisy Whistler	Modesty	Sirius
Dawn Play	Mrs. A. H. Austin	Soudan
Debonair	Ophir	Stampede
Dorothy McDade	Ortensia	Star of Gold



Fig. 190. Portion of *Hemerocallis* Test Garden at Cornell University.

Duchess of Windsor	Parthenope	Starlight
Dr. Stout	Persian Princess	Sweetbriar
Easter Morn	Pink Charm	Tamiami
Europa	Pink Lass	The Gem
Fantasia	Pink Lustre	The Yearling
Florham	Pert	Theodore Mead
Fulva Rosea	Potentate	Vesta
Fulva var. maculata	Prima Donna	Vulcan
Garden Lady	Princess	Welaka
George Kelso	Queen of May	Winsome
Georgia	Radiant	Zouave
Golden Bell	Red Bird	

5. HEMEROCALLIS TRIALS AT CORNELL

L. H. MACDANIELS, *Head*

*Department of Horticulture & Ornamental Horticulture
Cornell University, Ithaca, N. Y.*

The test garden area for ornamentals contains a considerable amount of other material besides *Hemerocallis*. The illustration (Figure 190) shows one of the beds which is given over to *Hemerocallis* clones. The general scheme is to plant three plants of each clone in succession in a row.

It is hoped that before another year goes by we will be able to give the *Hemerocallis* collection more attention.

R. H. S. COLOUR CHART

The readers will be interested to know that the "R. H. S. Horticultural Colour Chart" is again available. This work has been recently reviewed (Horticulture, Nov. 1947) by Dr. Donald Wyman, Arnold Arboretum, Harvard University, Cambridge, Mass. The price of the Chart is \$10.00 plus shipping charges. Anyone interested in obtaining this color chart should write directly to: Royal Horticultural Society, Vincent Square, Westminster, London, S. W. 1, England.

FLOWER PRESERVING PROCESS

STANLEY E. SAXTON, *New York*

Attempts to preserve the blossoms of *Hemerocallis* by means of the recently introduced "Jo-Fleur" process have proven a failure. The first group of blooms were picked early in the day and subjected to the first dipping according to directions. Some drooped and collapsed at once, especially the yellow types. Some retained their shape and were hung up covered with the frosty coating. By afternoon every blossom had spoiled.

A second group of blooms was tried. These were picked about noon. A slightly lower temperature was tried on the first immersion bath. Part were dipped at 120 degrees F; part at 125 degrees F, and part at the recommended 130 degrees F. This time several excellent blooms were obtained with the first coating. These were again hung up to dry, but by evening all the flowers were again limp.

Indications are that this process is not successful for preserving the blossoms of *Hemerocallis*.

REGISTRATION OF NEW AMARYLLID CLONES

Registrars: Prof. J. B. S. Norton and Mr. W. R. Ballard

This information is published to avoid duplication of names, and to provide a space for recording brief descriptions of new Amaryllid clones. Names should be as short as possible—one word is sufficient. It is suggested that in no case should more than two words be used. *The descriptions must be prepared in the form as shown in the entries below, and must be typewritten and double-spaced.* The descriptive terms used should be in harmony with those given in the "Descriptive Catalog of Hemerocallis Clones, 1892—1948" by Norton, Stuntz and Ballard.

There is close liaison between the AMERICAN PLANT LIFE SOCIETY and the HEMEROCALLIS SOCIETY regarding the registration of new *Hemerocallis* clones, and such new names can be sent to the registrars of either society and will automatically be included in the records of both organizations.

Correspondence regarding new amaryllid clones, including *Hemerocallis*, to appear in HERBERTIA should be addressed to Prof. J. B. S. Norton, 4922 42nd Ave., Hyattsville, Maryland, *enclosing self-addressed, stamped envelope, if reply is expected.*

For obvious reasons, there is a limit to the number of descriptions included from any one member in any one issue. Not more than five brief descriptions of clones under each generic heading will be published free of charge from any one member in any one issue of HERBERTIA. Additional descriptions may be published in the advertising section at regular ad rates. Descriptions of clones in excess of five brief descriptions, up to a total of 25, will be entered free of charge if the space required for each is limited to one line. In this case use should be made of the standard abbreviations already mentioned.

HYBRID DAYLILY (HEMEROCALLIS) CLONES

TRIAL GARDENS. Cooperative daylily trial gardens have been established at (1) *Cornell University, Dept. of Floriculture, Ithaca, N. Y.*; (2) *University of Florida, Dept. of Horticulture, Gainesville, Fla.*, (3) *Southwestern Louisiana Institute, Dept. of Horticulture, Lafayette, La.*; (4) *Whitnall Park Arboretum, Milwaukee City and County Park Board, Milwaukee, Wisc.*; (5) *Texas A. & M. College, Dept. of Horticulture, College Station, Texas*; (6) *Des Moines Park Board, Des Moines, Iowa*, (7) *Div. Ornamental Hort., Univ. of Calif., at Los Angeles*. [Complete addresses are given under *Officers and Committees, below.*]

Introducers should send complete collection of hybrids to these cooperating agencies in order that the new daylily clones may be impartially evaluated.

Introduced by Stanley E. Saxton, Saratoga Springs, N. Y.

Cotillion. (B. H. Farr X Redbird). A large brilliant orange-

scarlet flower. Segments near "Blaze Sheik," M&P 3J11 with blood red veins and a deeper glow in center of petals. Flower opens widely, closing after dark with little fading. Flowers 5", Scapes 34", late midseason. Seedling No. 48-136.

Charisse. (Rosalind X Sweet Sue). Regular flower, size and form of Rosalind, petals wider. Color "Tango Pink," M&P 3J8, with small eye marking of wild raspberry, M&P 6E6. Sepals a shade lighter. 15 to 20 buds. Early midseason. Flower 4", scape 38". Seedling No. 47-23.

Dryad. (Bobolink X Domestico). Small bicolor with wide light maroon purple petals, somewhat pinched at tips, and light yellow sepals. Slender stalks with multiflora branching. Free blooming with many stalks. Flowers 3½", scapes 24", Early. Seedling No. 48-2.

Griselle. (B. H. Farr X Theron) Medium small flower with very wide recurved and overlapping petals of raspberry red, M&P 3K9, veined deeper. Flower 4", Scapes 26", Early midseason. Seedling No. 46-8.

Originated and introduced by John V. Watkins, University of Florida, Gainesville, Florida.

Black Prophecy—Plant very prolific in northern Florida, multiplying rapidly to form large clumps. Foliage, deciduous, very late to start, upright, light green. The scapes are slender, stiffly erect, well branched, and hold the flowers upright in good arrangement. The flowers are small but very full as the broad tepalsegs are overlapping. The throat is chartreuse, the eye zone is not noticeably differentiated from the remainder of the tepalseg, and the setepalsegs and petepalsegs are of the same value. The color approaches mulberry fruit (M & P—Plate 56), with the veining slightly darker. This seedling, resulting from selective breeding for dark flower color, flowered first on April 15, 1945 and has been used in the breeding program subsequently because of the very dark pigmentation of its flowers, extreme earliness and well branched scapes.

Because growth is discontinuous and the plants have no garden value in winter time, ramets of this clone are being distributed among members of the Men's Garden Club of America who live in temperate sections of the United States. No distribution in the Deep South will be made, and no plants will be sold.

Introduced by J. B. S. Norton, Hyattsville, Md. (Named by George Gilmer, Charlottesville, Va.)

Genevieve. Height of foliage 24-30 inches, height of scape 30-46 inches, blooming June and July, orange. Flowers never fade in the hottest sun, and look well when wind and rain have bruised other bloom so that they are not presentable.

Introduced by Ralph W. Wheeler, Winter Park, Florida.

Ming Toy. A ruby red semi dwarf, early to flower and, being free with its stems blooms over a long period. It has stems up to 18" and has had as many as 30 flowers to a stem.

Olympus. This flower is huge, the largest in segment area of any seedling I have had. Also it has a beautiful, well open form and is car-

ried well on a strong stem which is sufficiently tall for this large flower. It is truly a magnificent specimen. The color is light orange with areas of a glistening, light peach dusting.

Psyche. A definite break in hemerocallis form. It is a very large flower with wide, very long segments which recurve as do the falls of an iris. The petals are beautifully creped and ruffled. The color is light yellow with a faint blush of dusting in the mid petal section. The throat is liquid green. Stems are four feet.

Vega. A semi dwarf in deep wine purple with a bright canary throat. The small flowers have very wide segments, are compact, well open and beautiful both in coloring and form. The stems are 16" and have held as many as 24 flowers.

Chanticleer. A bright crimson with a slight violet sheen; the throat is orange-yellow as are the narrow bands along the petepalseg midribs; the flower is medium large, regular in form, well open with the setepalsegs more recurved than the petepalsegs; the scapes are 30", and it blooms in mid-season in Florida.

Introduced by Mrs. H. W. Lester, Atlanta, Ga.

Gala. Midseason to late, deciduous. 36". Five inch bloom of glowing ruby red velvet. Stands the sun well. Two bloom periods.

Galahad. Midseason, deciduous. 30". Five inch bloom of dark maroon velvet. Very strong growth. Stands the sun well.

Laurel. Midseason to late, deciduous. 36". 25 or more blooms on well branched scapes. Satin smooth petals and sepals of bright laurel pink, with green throat. Two bloom periods.

Limelight. Midseason to late, deciduous. 30"; 6" to 7" bloom of lemon yellow. Petals broad and slightly revolute. A self in color and of porcelain like substance. Does not fade in hottest sun.

Marco Polo. Late, deciduous. 36". Strong growth. 25 to 30 blooms of bright red velvet. Darker eye zone. Well branched.

Peach Blush. E to M; de.; 40"; soft buff yellow, pink eye-zone.

Peachtree Beauty. M to La; de.; 30"; pinkish-buff.

Spotlight. E to M; de.; 50"; pale yellow.

Maid Marian (error, "Maid Martan," Myb. 2, p. 81. 1948).

Introduced by Mrs. Garrett (Marie) Hydeman, Grand Rapids, Mich.

Ives. 36"; M; R4D; ext.; (Leonian hybrid sdlg.) Brown red self, 4½" across. Petals and sepals recurving, blooms July 15th.; remains open after 8 o'clock at night.

Red Indian. 36"; M; R4D; ext.; (Leonian hybrid sdlg.) Red self, same color as Indian red artist's paint. 4" open flower; remains open after 8 o'clock at night. Starts to bloom July 7th., and repeats in October.

Turk's Cap. 36"; M.; R7D; ext.; (Leonian hybrid sdlg.) Dark red self, same color as Turk's Cap Lily. 4" open flower, medium width petals, blooms July 6th., remains open after 8 o'clock at night.

Introduced by Walter D. Button, Midlothian, Illinois.

Delta Song. 29 inches. July-August; garnet with Indian red edging. Wide, recurved petals. Mid rib on both petals and sepals. Golden cup. Flower $6\frac{1}{2}$ inches.

Talent. 30 inches. July. Florida gold self, clear. Flower $3\frac{1}{2}$ inches across.

High Hat. 36 inches. July-August. Ta-Ming yellow. Large 7 inch flower, recurved, clear color.

New Look. 26 inches. July; cowslip yellow. Small $2\frac{1}{2}$ inch flowers. Ruffled.

Gipsy Dance. 36 inches. July. Korea red. Wide petals; Chinese gold and tan sepals, Slightly ruffled. Light chrome yellow throat. Flower $3\frac{1}{2}$ inches.

Gay Greetings. 36" ; M ; Y7M.

Introduced by George Gilmer, Charlottesville, Va.

Portia. 36" high; a self blend, the color of Sunburst (M & P 10K9) with veins of Pond Lily (M & P 10K9), the overall effect being mellow-glow (M & P 10I6). Petepalsegs are frilled and slightly twisted, upheld by a strong midrib; setepalsegs are smooth and recurved. Does not fade and remains open evenings. Same color as the peach variety, Golden Jubilee. 5" diameter flower.

Introduced by Geddes Douglas, Nashville, Tenn.

Black Magic. Cup shaped. Deep purple-maroon. Green throat. 40 inches. Early midseason.

El Magnifico. Large open flower. Blend of bronze, yellow and red. Edges of petals ruffled. Orange throat. 38 inches. Midseason.

Peppermint. Modified Cup. Bright red. Petals and sepals have cream line down center and are edged with cream border. 42 inches. Midseason.

Pink Radiance. Modified cup. Large clear bright pink with deep geranium pink halo. 45 inches. Late.

Introduced by Ralph M. Schroeder, Warrensburg, Ill.

Fireball. (Parentage record lost, probably Matador x Rascal) Medium sized flowers with segments of good width. Velvety combination of red and orange. The color pattern is unusual in that the red of the outer portion of the petals seems to overlap the orange of the throat in a band about $\frac{3}{8}$ of an inch wide. Season of bloom July-August. 28 buds on a 32" stem. Seedling No. 47-106.

Golden Girl. (Kraus seedling x Mission Bells) Large 7" flowers with wide petals. The petals are somewhat curled and twisted. Color shades from deep golden yellow at the midrib of the segments to lighter yellow at the edges. Very weather resistant. Season of bloom June-July. 38 buds on a 42" stem. Seedling No. 48-42.

Naivette. (Moonbeam x Dauntless) Flowers 6" in diameter with petals $1\frac{1}{8}$ " wide. Recurving sepals give the flower a triangular form. Pale creamy yellow with a faint halo of fulvous pink which parallels the

outline of the flowers. 38 blooms on 45" stem. Seedling No. 47-73. Season of bloom July-August.

Introduced by Claude E. Rudy, Overland, Mo.

Waverly. Well rounded flower, similar in size to *H. fulva rosea*, the pollen parent, but a more uniform flower. Color—glowing dark rose with deeper eye zone on petals. Well branched 40" stalks. Good foliage. Free bloomer in late June—July. Stands hot sun very well. No. 43 (*Rajah* x *H. fulva rosea*).

Grandview. A mixture of ruddy orange, brown red, and bronze on a 45" stalk. Large well formed flowers 5"x7". Strong plant, with good foliage. Somewhat resembles Purple Waters, but much better formed flower, and stands hot sun better. Blooms late June-July. No. 47 (*Hyperion* x *H. fulva rosea*).

Belmont. A sister seedling of Grandview. Color is a blended mixture of copper, orange, and bronze. Size 4½"x6". Wide ruffled petals with faint tan midrib. Sepals are a smooth mixture of the above colors which gives a reddish copper effect with tan edges. Strong 38" stalk. Blooms late June-July. No. 48 (*Hyperion* x *H. fulva rosea*).

Eureka. Light reddish orange flower with deeper eye zone that extends half way up the petals in inverted "V" shape and is accented by faint tannish midrib. The large 6"x7" flowers stand the sun well. Petals are slightly ruffled, but sepals are smooth. The stalks are about 45", and the plant is a vigorous grower. No. 93 (*Hesperus* x *H. fulva rosea*).

Introduced by J. B. S. Norton, Hyattsville, Md.

Artemis. Scape 2-3 feet, flowers 5 inches wide, wide open, light yellow, M. & P. 9-L-1, setepalsegs ¾ inches wide, the sides nearly parallel, petepalsegs 1½ inches wide, widest near the apex which is round as a half circle. Day blooming and sun resistant, with thick tepalsegs, in July.

Albert Gorham. Scape strong but graceful, 5-6 feet high, flowers in July, 5 inches wide, wide open, setepalsegs light brown and yellow, M. & P. 4-I-11, ¾ inches wide, petepalsegs darker M. & P. 5-E-10, 1½ inches wide, with wide light midline giving the flower a very bold aspect.

Prevernal. Scape about 2 feet, flowers few, light yellow, 3 inches wide, star form, tepalsegs pointed. Very early, by protection from frost has bloomed April 18.

Introduced by Mrs. Joseph Bremken and Mrs. Floyd Armstrong, Omaha, Nebr.

Howdy. A bicolor. Sepals a light green yellow, Petals Morocco red with a broad greenish yellow median line extending the length of petals. Throat deeper green yellow. Flowers large and full of heavy substance and holding up well. Midseason bloomer. Stems 40 inches with good branching and many buds. A deciduous variety and fully hardy. Makes a brilliant spot. (*Hyperion* x *Black Falcon*.)

Prairie Girl. A polychrome. Deep chrome with wide petals flushed orange cinnamon and a faint eye zone slightly deeper in color. Flowers

large and full with a 5 inch spread, of good substance. Stems 50 inches with good branching and many buds. A midseason to late bloomer and deciduous grower. Throat sulphur yellow. (Annis Victoria Russell x Seven Seas.)

Introduced by (Henry E. Sass) Maple Road Gardens Sass Brothers, Route 1, Omaha 4, Nebraska.

Apricot Queen. Sdlg. 45-54; ML—Y4M. Apricot colored self. 40 flowers on a 40 inch stem. Blooming time from the first of August to late August.

Chief Fontenelle. Sdlg. 45—35; M—R5M. Petepalsegs are apricot orange, setepalsegs zinc orange, with darker eye zone. Fairly large flowers with 30 to 40 flowers on a three foot stem. Blooming time is mid-July to mid-August.

Copper Colonel. Sdlg. 45-18; M—S5M. Petepalsegs are Hays russet with yellow midrib, one and $\frac{7}{8}$ inches broad. Setepalsegs are yellow, heavily flushed Hays Russet. Greenish yellow throat. Height 40 inches. 40 to 50 flowers on a stem. Mid-July to Mid-August.

Gay Charmer. Sdlg. 45-2; M—S9L. Petepalsegs are vinaceous rufus with capucine midrib and throat. Setepalsegs capucine yellow flushed vinaceous rufus. Height 40 inches. 30 to 40 flowers on a stem. Mid-July to Mid-August.

Prairie Gold. Sdlg. 45-27; EM—Y4D. Dark orange self, ruffled. Medium to large sized flowers. Height 40 inches. Wide branching with 50 flowers to a stem. Blooming season from first of July to Mid-August.

Sungod. 40"; M; Y4D.

Introduced by Mrs. J. A. Womble, Fort Worth, Texas.

Ambrosia. 30"; M; S6L; de. A creamy flower with broad petepalsegs, setepalsegs slightly reflexed, both carrying different tints.

Kachina. 30"; M; Y4L; fr. Clear soft yellow. Tepalsegs ruffled.

Kismet. 36"; M; Y7D. Golden orange, broad tepalsegs.

Moon Magic. 48"; EM; R4M; ev. Orange star shaped flower.

Nancy Lee. 24"; E-M; Y4M. Large clear yellow self, broad tepalsegs.

Nicollette. 30"; EM; S8L. Petepalsegs the color of a ripe banana with shaded eye zone, setepalsegs overcast rose.

Temptation. 30"; MRe; R4M. Bright orange red. 4" bloom.

Tonto. 30"; M; R7M; ev. (The Alamo X Margaret Perry) Copper red, 4" bloom.

Tia Juana. 38"; EM; R7M. Wine red. 5" bloom.

Introduced by E. J. Kraus, Chicago, Illinois.

Autumn Daffodil. 30 inches. Leaves 30 inches, bright green, medium width, upright, recurved, forming well closed mass, 24 inches tall. Scapes 30 inches tall, slender, upright, 3 to 4 branched, 25 to 30 buds.

Flowers $2\frac{3}{4}$ inches in diameter, widely open; tepalsegs broad, overlapping, reflexed. Petepalsegs $2\frac{1}{2}$ inches long, 1 inch wide, ruffled,

lemon chrome to straw yellow, bright, clear, and glistening. Setepalsegs $2\frac{1}{4}$ inches long, $\frac{1}{2}$ inch wide, same color as petepalsegs. Free blooming starry flowers resembling daffodils. Faint pleasing odor. Blooms throughout August into September. (Sunny Morn x [(Dominion x Gypsy) x (Amaryllis x Golden West)]).

Bruno. 36 inches. Scapes sturdy, erect, 2 to 3 branched, 20 to 25 flowered, flowers well above foliage mass. Leaves medium width, bright green, upright, recurved at tips.

Flowers almost 4 inches in diameter, wide orange throat, slightly pointed upward, tepalsegs reflexed. Petepalsegs $3\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches wide, distal $\frac{3}{4}$, brazil red margined mars orange with large inconspicuous eye and veining, of Victoria Lake, orange base. Setepalsegs $3\frac{1}{4}$ inches long, $\frac{3}{4}$ inch wide, outer $\frac{3}{4}$ Dragon's Blood red margined madder brown with indistinct V-shaped, maroon eye spot. Reverse of both Brazil red margined orange. Very luminous with velvety sheen. Odorless. Holds color well in sun. Season last of June through July. (Dominion x Persian Princess).

Classic. 40 inches. Scapes sturdy, erect, 3 to 4 branched, 20 to 25 flowers borne about 1 foot above the foliage mass. Leaves upright, rather stiff, blue green.

Flower long tubular with wide throat and reflexed tepalsegs of thick texture, resembling an Easter Lily. Very fragrant. Petepalsegs 4 inches long, $1\frac{1}{4}$ inches wide, lemon yellow, lightening to picric yellow at margins with light green base. Setepalsegs 4 inches long, $\frac{3}{4}$ inch wide, same color as petepalsegs. An exquisitely formed patrician flower which holds its texture throughout the day and well into the night. (Hyperion x (Hyperion x Rajah)).

Companion. 32 inches, slender, upright, branched, 15 to 20 flowers. Flowers face outward and slightly upward. Leaves light green forming dense mass about 20 inches high around the numerous scapes.

Flowers long tubular with reflexed tepalsegs. Petepalsegs $2\frac{1}{2}$ inches long, 1 inch wide. Outer portion vinaceous tawny, base lemon chrome with large indistinct tawny eye. Setepalsegs same color, without eye. Reverse of setepalsegs cacao brown. Buds are very distinctive, large, borne erect, warm reddish chocolate brown. Odorless. Free, early and abundant bloomer, very effective with Siberian Iris. Third week in May through third week in June. (Gold Dust x Brunette).

Conqueror. 32 inches. Scapes numerous, slender, erect, 20 to 25 flowered, flowers borne 6 to 8 inches above the foliage mass. Leaves bright green, wide, 24 inches long, upright, recurved at tips.

Flower widely open with reflexed tepalsegs. Petepalsegs $2\frac{3}{4}$ inches long, $1\frac{1}{4}$ inches wide, distal portion madder brown, inconspicuous eye of Vandyke red, base cadmium yellow, margins ruffled. Setepalsegs $2\frac{1}{2}$ inches long, $\frac{3}{4}$ inch wide. Same coloring as petepalsegs, without eye. Very luminous despite the rich dark coloring. Holds color well in sun. Very free flowering. Middle of June to middle of July. (Persian Princess x [Modesty x (Dominion x Cressida)]).

Coral Bells. 24"; MLa; R4L; (Boutonniere x Sunny Morn).

Delicacy. 30"; MLa; Y4D; (Boutonniere x Pamela).

Double Eagle. 30"; M; Y4D; dble.; (Regal Lady x [Rajah x Golden West]).

Eric Junior. 20"; MLa; R7D; (Cressida x Rajah [self]).

Firecracker. 30"; EM; R7D; (Earlinna x Brunette).

Flames. 34"; MLa; R4M; (Cressida x (Rajah x self)).

Mabel Fuller. 36"; M; R7D; (J. S. Gaynor x [(J. S. Gaynor x Gypsy) x (Dominion x Cressida)]).

May Rain. 24"; E; Y5L; (Flavinia x Brunette).

Mrs. Charles Walgreen. 30"; EM; R7M; (Rosalind x [Gypsy x (Amaryllis x Golden West)]).

Mrs. Raymond Knotts. 36"; M; Y4D; (Vespers x Monona).

Primula. 42"; EMRe; Y4L; (Dominion x J. S. Gaynor).

Red Dot. 22"; EM; R8D; (Rajah x [(Bijou x Dominion) x (J. S. Gaynor x Rajah)]).

Ringlets. 30"; EM; Y4D; (Mrs. W. H. Wyman x Rosalind) x ([Dominion x J. S. Gaynor) x (Dominion x Cinnabar)]).

Rosario. 32"; M; R7L; (Rosalind x [(Cinnabar x (Dominion x Gypsy)]).

Sunny Morn. 34"; M; Y4L; (Mrs. W. H. Wyman x self).

Mrs. David Hall (Kraus, 1948); Myb. 2, p. 81; 30"; M; S8M; (Dominion x Amaryllis).

2. GENETICS AND BREEDING

THE CLIVIAS AT SCOTT'S FARM, GRAHAMTOWN

CYTHNA FORSSMAN,

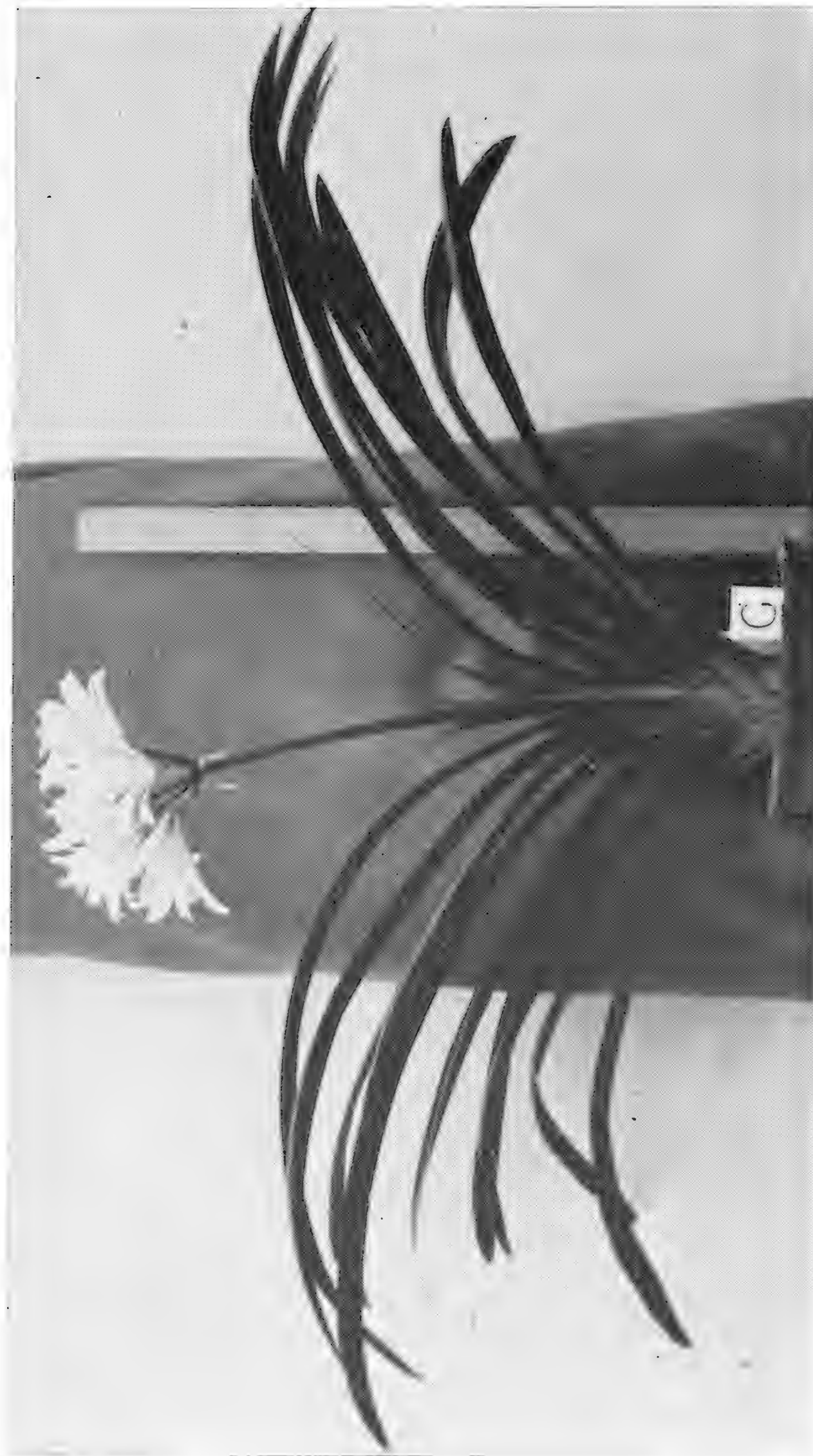
Division of Botany and Plant Pathology, Pretoria

In the 1939 volume of *HERBERTIA*, Miss Blackbeard of Scott's Farm, Grahamtown, gave a short introduction to her *Clivia* collection. It seemed desirable to have some of her results recorded in colour and it fell to my lot to do the work. It seemed fitting also that the second volume of *HERBERTIA* to be dedicated to South African *Amaryllidaceae* should continue the story of the Scott's Farm Clivias, and it is hoped that that use may be made of my colour impressions. [Editorial note.—Unfortunately, due to post war conditions, it was not possible to reproduce the very beautiful color plate submitted by Mrs. Forssman. It is hoped that it may be possible to interest the Editor of *LIFE* magazine so that this fine color plate may be given to the public. It shows (A) a flower of original plant of *Clivia miniata* in garden at Scott's Farm; (B) a flower of hybrid, from Pietermaritzburg, Natal; (C) flower of *Clivia miniata* var. *flava*, from Pietermaritzburg, Natal; (D, E, F) flowers from progeny of the above and other parents; (G) fruit of *C. miniata* var. *flava*, and (H & K) fruit of hybrids, showing variations in shape and color. All of these are done most beautifully in color.]

Miss Blackbeard's Clivias must be seen to be believed. It was on a grey day that Mr. R. Story (Botanical Survey Officer) drove me down to Scott's Farm and the rain clouds were hanging heavily over Grahams-town. On our arrival, a tall woman of about my own age detached herself from a group of coloured men who were arguing and gesticulating over the corpses of three enormous Cycads (*Encephalartos*). She came towards us with outstretched hand and we were surrounded by and included in the warmth of welcome extended to any man, beast or plant, irrespective of degree of colour, who arrived at Scott's Farm. She had rescued the Cycads, she told us, from a garden which was being modernized. Nine men were needed to lift the branched veteran, seven had been enough for the others. Although they had been hacked off above their roots, she hoped they would again strike roots if she planted them in sand.

Then Hardy introduced himself by giving me a good bite on the ankle. He is a quiet, self-possessed bird with a nip for everyone except his beloved mistress. He had been brought to her by some urchins as an unprepossessing Hah-di-dah chick which had fallen out of its nest, and now he owned the place. The pair of owls, which had both turned out to be females, who were contentedly hatching some Bantam eggs, the wild duck on its nest among the reeds, the numerous dogs, fowls and geese did not dispute ownership with Hardy.

And then the Clivias, which in their off season live in a large rambling rush-house, were presented to us. They all started from *Clivia*



Clivia miniata var. *flava*, from Pietermaritzburg, Natal



Clivia miniata hybrid from Pietermaritzburg, Natal



Good example of flowering *Clivia* hybrid at Scott's Farm, Grahamtown

miniata, a stout hardy specimen planted in the garden by Miss Blackbeard's mother. The flowers are a deep orange-red and the petals are thick and leathery. Then *Clivia miniata* var. *flava* (Plate 319) was introduced from Pietermaritzburg, Natal, and then the crossing began. After that various hybrids were procured from Natal (Plate 320) and Zululand and the result is the wonderful show of exquisite blooms, ranging in colour from deep orange-red, through every shade of apricot and salmon-pink to pure cream (Plate 321). Some have white centers, some have striped centers and they have all been arranged on the stoep of the farm-house. With their dark green and shining strap-shaped leaves they made a picture that will live with me forever. *The painting of the Clivias*. My first feeling was of utter bewilderment. The weather was unpropitious and the time allotted to me would not allow of my ambitious scheme, so I decided to do one flower from each of the six main parents and then two or three of the most striking hybrids.

HYBRID **AMARYLLIS** IMPROVEMENT

WYNDHAM HAYWARD, *Florida*

When one considers the progress in the breeding of fine Hybrid *Amaryllis* made in the last three decades of the 19th century and the first 20 years of the 20th, and compares the extant records of the breeders' achievements, as evidenced by the products they created, which may be seen in photographs of the period in various old catalogues, horticultural magazines, etc., one has to come to the conclusion that the subsequent thirty years have contributed little to the work of Veitch and Ker and their contemporaries.

It might even be said that the breeding of hybrid *Amaryllis* has gone into a sad decline. The breeding, not the growing of these magnificent bulbs, which have formed the nucleus of many showy conservatory collections in the last 75 years.

Some other time we may be able to discuss with more careful consideration the decline in the culture of choice types of Hybrid *Amaryllis* since Messrs. Veitch, Ker, etc. dropped the torch of breeding this interesting and beautiful tropical American bulb.

Who wishes to delve into the botanical and horticultural background of our present-day Hybrid *Amaryllis*, which are being maintained on a high level of culture in only three or four countries today, can find much to interest him in the volumes of the botanical and horticultural papers and magazines of the period from 1870 to the present day, also in such specialized monographs as "Die *Amaryllis*," published in German in 1909, the work of the late Henry Nehrling, pioneer Florida horticulturist and plantsman.

The well known, but now scarce veteran hybrid *Amaryllis*,—*A. xJohnsonii*, dates back to the late 18th century in England. There were several species available during Dean William Herbert's time, in the first half of the 19th century; in fact, in his "Amaryllidaceae," 1837, he

lists *A. aulica*, *A. calyptrata*, *A. psittacina*, *A. elegans* (syn.-*A. solandri-flora*), *A. ambigua*, *A. breviflora*, *A. reticulata*, *A. belladonna* Linn. (syn.—*Hippeastrum equestre* Herb., *H. barbatum*), *A. stylosa*, *A. Reginae*, *A. glaucescens*, *A. striata* (rutila) and many varieties. Herbert discusses numerous hybrids, ("cross bred seedlings" he calls them) from the time of the original reginae-vittata cross which is alleged to have produced



Fig. 191. Hayward Strain Hybrid *Amaryllis* shown in upper left & right, and lower left; *Amaryllis striata* hybrid from van Tubergen shown in lower right. All grown by Wyndham Hayward, Winter Park, Florida.

xJohnsonii, and reproves Sweet for "overwhelming" the natural species of this genus with a plethora of Latin-named mere crosses.

On pages 143 and 144 of his "Amaryllidaceae," Herbert lists 31 recognized *Amaryllis* hybrids which had been given names up to 1837, starting with *A. xJohnsonii*. None of these hybrids with the possible exception of *A. xJohnsonii* remains in cultivation today. And we are not even sure about *A. xJohnsonii*. What we have under that name

today may be a seventh generation seedling of the original, or some other species or hybrid entirely.

Between 1837 and 1948, literally thousands of outstanding hybrid *Amaryllis* have had names given to them. It is the custom at many notable flower shows, such as the International Shows in New York and the Royal Horticultural Society shows in London, to apply a name to a fine type of Hybrid *Amaryllis* which receives some recognition or award at the shows. In the previous volumes of "Herbertia," there have been many valuable and beautiful named varieties of hybrid *Amaryllis* listed and described.

Back in 1934, perhaps the supreme named variety of Hybrid *Amaryllis* was a Heaton seedling named "President Roosevelt," which was voted "best flower" that year at the first annual show of the American Amaryllis Society, now the American Plant Life Society. Almost every grower, at various times has introduced certain fine types of *Amaryllis* under name. Some have had extensive catalogues of named varieties, as the late Luther Burbank, and only a few days ago the writer received a price list of named hybrid *Amaryllis* from an Indian nursery containing more than 75 varieties.

In the only catalogue of Luther Burbank that we have seen the small numbers of bulbs and offsets available were listed with price. In the Indian catalogue just at hand the prices range from 25 cents each for "Johnsoni" to \$2.50 and more for selected types, but there is no indication how many of the bulbs of each variety are available.

So it may be said with justice that in no plant of similar outstanding horticultural merit, so worthy of wide culture and possessed of so much popular appeal, has there been such an ephemeral character to the named variety situation. Back in 1934 I. W. Heaton named his flower "President Roosevelt" and propagated the bulb by vegetative means, and it proved adapted to this type of multiplication. But in the years since then, the variety has virtually disappeared in the trade, so far as the writer is aware.

Doubtless the lack of an easy, scientific method of propagating the bulbs of hybrid *Amaryllis* vegetatively was a major factor in the checkered career of this horticultural favorite over the decades since *xJohnsonii* was created (1796-1810, according to various authorities.) However, this problem of vegetative reproduction of named varieties is no longer the stumbling block in building up stocks. Efficient and successful methods for cutting up bulbs and growing new ones from the pieces were worked out by Miss Ida Luyten in Holland and extended in treatments by I. W. Heaton, Dr. Hamilton P. Traub and others in Florida in the late 20's and early 30's of this century. Dr. Traub obtained as many as 90 bulblets by cutting up a single large *Amaryllis* bulb.

So—the problem today remains one of breeding, culture and vigor of the strain. Many fine plantings of hybrid *Amaryllis* have "gone bad" in Florida, and only the most intensive culture in greenhouses has brought the English and Holland strains to their present fine state.

We do not know enough about the cultural requirements of the hybrid *Amaryllis*, at least under outdoor conditions, as prevails today with 95 per cent of commercial hybrid *Amaryllis* cultures in Florida, Texas and California, where most of the bulbs are grown. What attraction for a grower is there to invest in choice European strains in large quantities for seed or parent stocks, if he knows that he may lose most of his imported bulbs in a few years under outdoor growing conditions, as so often happens both in California and Florida?

There are several avenues of approach for the serious-minded and scientifically inclined *Amaryllis* grower. If he considers that the constitution of the European bulbs has been undermined by generations of inbreeding and greenhouse culture, and this may very well prove to be a fact; the ambitious *Amaryllis* grower of the future might choose to return to the species, and go through the breeding experiments of Veitch and Ker and all the rest all over again with careful selection of handsome, vigorous types. This might work, but would take many generations of seedlings as it did in the first place. The most vigorous types of hybrid *Amaryllis* unfortunately are not always the most beautiful.

However, it must be stated, that there ARE vigorous types of hybrid *Amaryllis*. Especially in the bulbs commercially grown in Florida by the acre in the open sun, often in orange groves, as the Mead Strain, which resulted thirty years ago from two acres of *Amaryllis* bulbs grown by the late T. L. Mead of Oviedo for the market. He was the first large scale grower of hybrid *Amaryllis* in the United States, and obtained his breeding and seed stock from the late Henry Nehrling's collection of choice hybrid seedlings and imported stock. Nehrling imported the finest varieties then available from European hybridizers.

These ordinary Mead strain bulbs are grown by the thousands in Florida in the Norfolk sandy loam soils, right in the open air and hot summer sun, and they have to be tough to survive. Some of them grow to four and one half inches in diameter in three or four years and bring 40 or 50 cents each in dime stores. But the flowers in 99,999 out of 100,000 cases are not of show quality. They are hybrid *Amaryllis*, and to any lover of the hybrid *Amaryllis*, any *Amaryllis* is an interesting and attractive flower, but only a few are outstanding in color, texture, shape, etc.

In the September, 1948 issue of the Journal of the Royal Horticultural Society, the noted English horticultural writer, Charles H. Curtis, pays an over-due tribute to Robert Pearce, plant explorer and collector, in his article, "The House of Veitch" on page 286. Curtis relates that during Pearce's second expedition to South America for Veitch in 1865, the plant explorer collected among other things, *Amaryllis pardina*, and *A. Leopoldii*, both of which had an extremely important part in the development of the modern hybrid *Amaryllis*.

So the scientific breeder of tomorrow, who wants to raise a new and greater race of hybrid *Amaryllis* can go back to 1865, if he wants that, and send forth into the wilds of South America for the original species (it would not be such a bad idea as the writer would certainly like to see the famous *Amaryllis Leopoldii* in the "flesh" after so many years).

Or he could, and this is the writer's personal opinion, better spend his time breeding a new strain using pollen of the handsome, but weaker, inbred, and more delicate bulbs of the best European hybrids (Figure 192), on the flowers of the best available types of the tougher American outdoor-grown strains, such as are found in California and Florida by the thousands, and are sold in seed stores for a few cents per bulb, while their distant high-bred relatives are imported for a "carriage trade" in the bulbs which is willing to pay \$2.00 to \$25 each, such as the top quality bulbs are bringing today.



Fig. 192. Hybrid *Amaryllis*—pure white, from van Waveren, as grown by Wyndham Hayward, Winter Park, Florida.

Thus will be brought together the finest seedling and vegetatively propagated strains in the European trade and the tough, sturdy, sand-grown bulbs of the American commercial grower who raises them like potatoes and sells them according to size, not quality. Accompanying this article may be seen some snapshots of the writer's own strain of hybrid *Amaryllis*, bred along these suggested lines (Figure 191), which was approaching the fourth and fifth generation before World War II put a stop to the breeding experiments and projects at Lakemont Gardens for the "duration" and one year more.

These bulbs produced flowers four to the stem, with large, flat faces, broad petals, and rounded or pointed petal tips. No attempt was made to grow bulbs of a single shade together or cross bulbs of the same shades, as is the custom in Holland today where pure whites, scarlet, orange, "pink" dark red, salmon and sometimes a few other shades are offered, also seed of these shades. So successfully have the Dutch growers developed their lines of seedlings by shades that they are now selling "separate color" bulbs as soon as they reach size, without having seen them in bloom. In some cases where the color shades are not yet fixed, this proves dangerous, as bulbs of quite different colors appear in the progeny, but these are usually in small quantity. Of course there is always the possibility of a physical mixing of the bulbs or seed in the growing establishments through accident.

At this time the writer has two generations of seedlings coming along toward a further development of his pre-war breeding projects in hybrid *Amaryllis*. It is to be hoped that more *Amaryllis* enthusiasts (and they must be true enthusiasts as only a "fan" will give the time and trouble at this stage of the game that the task requires) will engage in *Amaryllis* culture with an enlightened background knowledge of the fine European strains and their history and cultural methods, and devote attention to new breeding projects, the development of sturdy, fast-growing bulbs, bearing strong bloom stems and good type blooms of attractive colors, which bulbs will lend themselves to easy vegetative propagation in the greenhouse or open air lathhouse, in warm climates.

There should also be research into the cultural side of Hybrid *Amaryllis*, to determine what their fertilizing requirements are, to maintain the bulbs for years in a healthy condition, also the desirability of various manures, types of humus, and chemical fertilizers in their growing. Insects and diseases have seldom proved a deciding factor in the failure of *Amaryllis* plantings, but more attention to these phases of the *Amaryllis* problem might reveal some surprises in the way of unknown nematodes, mosaics or blights which may be responsible for much of the grower's difficulties all unknown to him. We want plant explorers to bring in old and new species to provide new plant "blood." The hybrid *Amaryllis* is one of the world's most lovely and showy flowers, and can very well be on the threshold of a new day in horticulture. We have tried to point out in this article a few of the problems and also possible avenues of solution for at least some of these. There are many other points which could be brought into the discussion, as the use of colchicine or X-rays, etc, to change chromosome numbers and increase the possibility of important mutations in the species and hybrids, the use of hormones, and the application of the whole gamut of the new organic chemicals to the physiology of the bulbs, but we will leave that for some one more versed in that data and say in conclusion that it is our hope that the impression gained will be one of personal tribute to the plant, which we love and grow in spite of its not-so-serious failings!

THE LUDWIG HYBRID **AMARYLLIS**

LUDWIG & Co., *Holland*

The firm of Ludwig & Co., in Holland, still continues to grow its excellent strain of Giant Hybrid *Amaryllis* as in the past. The bulbs produce at least two flower scapes per bulb, with from three to four flowers in the umbel. The flowers have a well-formed shape, and the colors are clear. The following is a list of the named clones:

Early White, pure white, very large flowers.

Snow Queen, pure white, early flowering.

Kaspar Ludwig, pure white, excellent for pots.

Nivalis, white, greenish throat.

Scarlet Leader, dark scarlet, strong grower.

Red Guard, beautiful red.

Franklin Roosevelt, dark red carmine.

Brilliant, dark red, enormous flower.

Orange King, orange red, splendid shape.

Cherry Red, color cherry red.

Pink Favorite, pure pink.

Fantasy, attractive rose, lighter throat, and tepal margins.

Liberator, salmon pink, light striped.

Salmon Joy, salmon orange, excellent.

Mona Lisa, delicate salmon.

The firm has recently produced a new strain of Mignon Hybrid *Amaryllis* from a cross between the large-flowered hybrid *Amaryllis* and *Amaryllis striata* Lamarck (syn.- *Amaryllis rutila* Ker-Gawler), producing scapes 22 inches tall. The bulbs are from 6—8 inches in circumference, and all give from 2 to 3 scapes per bulb; and usually carry 4 flowers per scape. The flowers are much smaller than the usual Hybrid *Amaryllis*, but are nevertheless very elegant for table decoration and other decorative purposes. The colors range from reds, scarlets, pink and salmon shades, striped varieties, and still others.

THE BULLER HYBRID **AMARYLLIS**

HAMILTON P. TRAUB

Under date of July 28, 1947, Arthur C. Buller of Dwarsriviershoek, Stellenbosch, Cape Province, South Africa, sent some excellent kodachromes of his superior Hybrid *Amaryllis* strain which were received too late for mention in 1947 *Herbertia*. We take this opportunity of reproducing four specimen photos representative of the large lot of kodachromes,—(1) the best white (Figure 193) produced so far, (2) two blooms (Figures 194 & 195) from a large group of new brilliant colors—male parent had background distinctly chrome-yellow shaded, and this has given the unusual brilliance to the scarlets and other reds, and (3) one bloom (Figure 196) from a recent lot of superior seedlings.

The kodachromes submitted by Mr. Buller show unmistakably that he has developed a superior strain of Hybrid *Amaryllis* which deserves

the attention it is receiving from the most discriminating *Amaryllis* breeders in other parts of the world. Mr. Buller apparently is a very modest man and we have not been able to obtain an article about his achievements from him. We are pleased however to be able to include the following account based on a report contained in a clipping from a local newspaper sent us by Mr. Buller under date of August 20, 1948,—Many hundreds of flower lovers from all over South Africa as well as those from overseas have during recent years become acquainted with the splendor of modern hybrid *Amaryllis* (syn.— *Hippeastrum* Herb.) as



Fig. 193. Buller hybrid *Amaryllis*— best white seedling to date; note full form and fine texture. From kodachrome by A. C. Buller, South Africa.

raised by Mr. A. C. Buller of Dwarsriviershoek in the Stellenbosch district.

This exotic flower, whose forebears came from Mexico, the West Indies, Central America and South America, one species extending to west-central Africa (Prince's Island in the Congo estuary), has for many decades—in hybrid form—been one of nature's most showy subjects in the home garden and especially at larger spring shows in many countries. Those of the public who attended the October shows in Cape Town and Stellenbosch last year were surprised and delighted to see the unusual quality and coloring of these South African raised hybrid *Amaryllis* seedlings in shades from pure white through a wide range of scarlets,

flame scarlet, pink, rose and carmine and on to the deepest maroon crimson.

That experienced judge of plants, the director of public parks, Cape Town, Mr. van den Houten, commented at the time that these hybrid *Amaryllis* would be hard to match anywhere in the world.

It has taken Mr. Buller close to fifty years of "hobby" enjoyment to reach the present standard of quality and many thousands of hand pollinations and records have been made. With a view of testing out the critical judgment of overseas experts, a few of the newer plants have in recent years been sent over to the gardens of the Royal Horticultural



Fig. 194. Buller hybrid *Amaryllis*— flower of unusual brilliance; parentage described in text. From kodachrome by A. C. Buller. South Africa.

Society at Wisley, Surrey, England, where they have become acclimatised.

Three were shown at one of the large London shows last spring and all three were given an "Award of Merit." . . . The bulbs that Mr. Buller sent to England were later accepted by His Majesty, the King, for Windsor, where they will have the best possible care, and the flowering *Amaryllis* plants will be most skillfully exhibited by the staff of the Royal Gardens to the joy of many thousands. This is a signal honor for a South African hobby plantsman, a recognition of the quality strain, and an assurance of its preservation for future flower lovers.

AMARYLLIS BREEDING, SEASON 1946—1947

HERMON BROWN, *Chairman,*
Amaryllis Committee
Gilroy, California

For the past three years, it has been difficult to attend to my duties as a prune grower, and at the same time, to do as much as I had hoped to do with my hobby—*Amaryllis* breeding. Progress would have been more rapid had there been other *Amaryllis* growers near, with whom to exchange bulbs, seeds, pollen, and ideas. But, by importing new



Fig. 195. Buller hybrid *Amaryllis*— flower of unusual brilliance; parentage described in text; from same lot as Fig. 194. From kodachrome by A. C. Buller, South Africa.

stock from Holland, and exchanging pollen, and seed with growers in various parts of the U. S. A., and Australia, I have raised some five thousand new seedlings each year, and, therefore, have obtained many more good blooms each year (Plate 322).

My colors are mostly pure white, various combinations of white and red, down to pure red. Last year I had some pure pink, and pink and white. This year I increased my numbers of these same colors, and had a much larger lot of pure reds.

I can see improvement from my additions of Du Pont, and Holland stock, but these seem to lack the hardiness that my original stock had. However by selecting the best of these, as to form and color, when one or two years old, and planting them out in the field and leaving them until they come into bloom, I find that nature will eliminate most of the weaker ones, and many will become fine sturdy bulbs.

In my new breeding stock, I often find descriptions of color difficult, although I have the fine Royal Horticultural Society Color Chart.



Fig 196. Buller hybrid *Amaryllis*— selection from most recent seedlings; note rounded form and fine texture. From kodachrome by A. C. Buller, South Africa.

My last importation of Holland bulbs was pleasing, but the colors were not what I had expected. I am anxious to get some of the Leopoldii Type—pink, crimson and salmon selfs, as these will add variety to my collection.

I now have some seedlings from the late Mr. Ernest Braunton's collection, who started with *Amaryllis* \times *Johnsonii* which he crossed with pollen received from Howard & Smith, Houdyshell, and Rice. Then being particularly pleased with his results, he continued his crossings

with pollen from my best pure whites and pure reds. Then a "Friend" sent him seed of the "Best *Amaryllis* in America." After Mr. Braunton passed away, his wife sent me some of the last seedlings from these "Best *Amaryllis* in America," and naturally I am looking forward, in eager expectation, to the time when these seedlings bloom.

Mr. Wheeler, of Florida, very kindly sent me pollen from some of his best *Leopoldii*. Mrs. Strout, of Kentfield, California sent me a few seeds, and later she sent pollen which she had received from Mr. Bul-



Fig. 197. Hermon Brown hybrid *Amaryllis*—pure white, 8-inch diameter. Photo by W. M. James, California.

lock in Australia. All these with crosses from my own best stock, give me something to look forward to.

The great pleasure of the *Amaryllis* is the large showy flowers—beautiful shape, color and substance, and wonderful variety that hybridizing brings.

We have greatly missed the the kindly criticism and helpful suggestions of our friend, Dr. Traub, who used to visit us once a year during his recent stay in Salinas, Calif. Also it was disappointing to be obliged



Herman Brown, Chairman of the Amaryllis Committee, and a portion of his hybrid Amaryllis field; note portion of
prune grove in background.
Plate 322

by illness to forego our annual "Open House" during the latter part of April. In former years, many visitors have come to see the greenhouse display of my best blossoms. But some friends did come anyway, among them Mr. W. M. James, whose splendid illustrations appear with this article (Figures 197, 198 & 199).



Fig. 198. Hermon Brown hybrid *Amaryllis*—White with red stripes, 8-inch diameter flower. Photo by W. M. James, California.

AN **HAEMANTHUS** HYBRID

L. S. HANNIBAL, *California*

Broad leaf *Haemanthus* have not been particularly popular when in flower due to the dowdiness of their blossoms. It is therefore with particular pleasure that the writer can report that these plants have some interesting possibilities. In 1944 the writer pollinated the little *Haemanthus albiflos* var. *Burchellii* (See HERBERTIA Vol. 10, P. 170) with pollen of the well known *Haemanthus Coccineus*. It was an easy cross to make and it was soon apparent when the seeds began to sprout some months later that something had happened; which is usually not the case with many attempted Amaryllid crosses.

The little *Burchellii* has small hairy leaves that are quite sensitive to sunlight. No coloring or red pigmentation is evident in either the leaves or flower. *Coccineus* in turn has the large flabby winter leaves that are semi drought resistant, and these bear pigmentation stripes along the under side of the keel. The flowers are more or less brick red, as is the five-valved spathe.

The hybrid is winter growing with leaves appreciably smaller than *Coccineus*, but just as hardy, excluding frost. No hair is noticeable and



Fig. 199. Hermon Brown hybrid *Amaryllis*—pink with edges of tepalsegs ruffled, 8-inch diameter flower. Photo by W. M. James, California.

only a trace of pigmentation can be seen at times. The dormant or rest period, when the plant sheds its leaves, lasts some six weeks only. Then, with the appearance of the new leaves a white bud emerges. As it develops the white gives way to a soft pink, then a coral red as the spathe opens. The flowers are inconspicuous but the anthers with their yellow pollen make a striking contrast with the coral red spathe valves and scape. In fact these parts seem to bring out all the desirable features

that are non existant in the scape or spathe valves of either parent.

It is to be noted that *Haemanthus albiflos* has been crossed with *H. coccineus* previously (Bot. Reg. 382, *H. Clarkei*, Hort.). However, since there are a number of white *Haemanthus* species in circulation (The writer has three distinct types) it is evident that the hybrid described above is in no way a repetition of the Clarke hybrid. The writer obtained his *H. albiflos* var. *Burchellii* from Perry Coppens, and he in turn brought it in direct from the Cape area. As far as known it has not been grown by European or American collectors previously.

In several respects all *Haemanthus* are unique since the spathe-valves are tending toward a development whereby they take over the function of the tepalsegs. It is not so evident with the species, but the deep pink tulip-shaped bud of the writer's hybrids appear to be anything but an Amaryllid, and it is a striking example of the evolutionary trends of this strange genus.

Unfortunately, and somewhat strangely, the hybrids are not inclined to produce offsets. To date none have appeared on a dozen bulbs. Perhaps this difficulty can be overcome as the F-2 generation evolves, but it is something that was not anticipated when one sees the rapid development of offsets from the little *Burchellii*.

FRAGRANT ALSTROEMERIAS IN FLORIDA

MULFORD B. FOSTER, *Florida*

Definitely we are going to enjoy alstroemerias in Florida gardens and that time is not far off. For the past eighteen months there has not been a day without an *Alstroemeria* bloom in our garden. The blooming calendar runs like this:

December, January and February: *A. caryophyllaea*

March, April, May, June: *A. caryophyllaea* hybrids

June, July: *A. caryophyllaea* hybrids; *A. psittacina*, *A. nemorosa* and *A. inodora*

August, Sept. Oct. and Nov.: *A. caryophyllaea* hybrids

Of course, not all of these alstroemerias are fragrant but *A. caryophyllaea* and nearly all *A. caryophyllaea* hybrids are.

In this calendar I have not included the Pacific Coast (Chile and Peru) species such as *A. aurantiaca*, *A. chiliensis* hybrids, *A. ligtu* and others because they have made such unsuccessful attempts to live here. Some of them succeed in showing a few bright flowers on sprawling stems and as soon as the flowers have "smiled" their last attempt, the plants start to disintegrate at once as the bulbous roots have already started to rot away. They just do not like Florida, at least not South and Central Florida, and after several years of patiently trying to find and give them the right soil and other conditions, I, like these disappointed alstroeme-

rias have had to admit defeat. Undoubtedly the Pacific Coast species, in their native habitat, have moist, rainy conditions when it is cold.

I tried them out more times than I might ordinarily have done had I not wanted to cross them with the Brazilian species. Their range of clear colors was so nice that the combination seemed to be the ideal in view.

The unsuccessful results from cross pollination with the West and East Coast species was even more definite than any attempts to grow the Pacific Coast species. Each year I tried again and again to take pollen from the few flowers that managed to struggle to maturity but to no avail. Then, my good friend Harry "L-stroemeria" Stinson of Seattle sent me, on several occasions, generous bunches of lovely, colorful flowers from his garden for use in hybridization, but the results were nil. They just won't cross for me at least. They don't like Florida nor will they exchange genes with their Brazilian East Coast cousins.

We could be "upity" about it and say "well we didn't want any of them here anyway." But, instead we will be very happy over the fact that we will have just about every color in the rainbow in the hybrids of those that *do thrive* here.

The Brazilian species seem, so far, to be the best for Florida because in Brazil they have the rains in their hot seasons as we do here in Florida. Also, all of the alstroemerias which I have from Brazil are shade loving plants, preferring to be in acid soil. These prerequisites can be easily given in a Florida garden especially along the azalea beds where shade and soil are ideal.

I now have four generations of crosses using *A. coryophyllaea*, *A. psittacina*, *A. inodora*, and *A. nemorosa*. The range of color is wide and the results are most gratifying, both as to form and size. The foliage is dark green and holds up well when cut. In fact it lasts two weeks as a cut flower in summer weather and longer in the cooler months.

So far, I find that all the Brazilian species and hybrids move easily at any time of the year—even when in bloom!

Then too, we can feel a little smug about the fact that practically everyone of them carry at least a bit of that lovely carnation-like perfume which has been generously sprayed over all the children and grandchildren of the *A. carophyllaea* hybrids.

Mr. Stinson has written (*Herbertia* 1942, page 125) of his unsuccessful attempts to cross the Brazilian species, *A. psittacina*, with some of the Pacific species, and to date, I believe, he has been without fruitful results. Dr. Traub (*Herbertia* 1943, page 132) has attempted to cross *A. psittacina* and *A. haemantha*, also without success. It is to be hoped that other growers will try whenever the opportunity presents itself.

In October 1948 I expect to again visit the areas in Brazil where alstroemerias thrive and I hope to find additional material to add to our happy alstroemeria "family" which is doing so well in our Florida gardens.

KODACHROME AND DAYLILIES— A TRIBUTE AND A WARNING

J. MARION SHULL, *Maryland*

A number of plant breeders indicate almost overpowering reliance on Kodachrome for recording hundreds of seedling *Hemerocallis* for future reference and comparison in color, size and form. This is a rather fascinating idea but I wonder if the results warrant quite such an expensive method.

Now Kodachrome is a wonderful product and I seldom see a good slide that I do not marvel at the excellence of its definition. I have a slide for instance in which a grown young woman crouches among the flowers within the small space of 35 millimeters but so cleverly is the detail handled that I can see the perfect outlines of the nail of her little finger. In another a whole Iris plant is shown within that same limited space and yet I can see distinctly the stigmatic lip of an individual style branch facing the camera. That is high tribute to any photographic material.

And as for color, most colors may be rendered with great fidelity and satisfaction, but I wish to add a word of caution. We must not fall into the error of assuming that because it is a photograph it must of necessity be a correct color representation of the flower photographed. Sure, it looks like that, the unwary photographer insists. It's a PHOTOGRAPH and photographs don't lie! I took it myself! A very easygoing assumption on the part of the photographer but utterly unsafe to rely upon.

With all its perfections, Kodachrome is not equal to so gigantic a task under any and all circumstances. In all cases the exposure in relation to the light available must be exactly right if satisfactory results are to be attained, and in some cases not even the most careful relation of light to exposure will turn the trick. Suitable filters will sometimes help, but no filter serves for every problem in color differentiation.

Some years ago I had occasion to record in Kodachrome the bloom of *Oenothera* or Evening Primrose being grown by the thousands at Princeton for scientific purposes. Involved were an extremely luminous yellow, the normal leaf green, and the brilliant red of unopened buds. Any exposure that would tender the greens or reds would so greatly over expose the yellows that they came out practically white, losing all the delicate nuances between sulphur, lemon and old gold that were really there. I could record these things in my water color paintings, but alas no white reflecting surface could possibly record the luminosity found in the Evening Primrose. This handicap is the bane of every artist who tries to paint on paper or canvas the colors that Nature displays to him on every side. The brilliance of Nature is entirely impossible to him and can only be suggested by whatever subterfuge he has at his command.

I have photographed my own *Hemerocallis* clone Cherokee Maid which I describe as purplish bronze and the best-timed Kodachromes

of it give a very good rendering of it when thrown on the screen—but I have had this same variety rendered as the most wonderful bright crimson, as brilliant and clear as the best red rose ever grown. Such a daylily would be beyond price did it really exist, and my photograph insists with all its magnificent detail that such a one does exist, but I know better. It all came about through a very slight under exposure, and I can produce any number more in the same way at will.

Kodachrome slides will be a good recording of form, of carriage maybe, and of comparative size, but no Kodachrome of a *Hemerocallis* can safely be accepted at its full face value as to color unless or until the viewer has had opportunity to look upon the flower itself and compare the slide for accuracy of color rendering.

NEW **HEMEROCALLIS** HYBRIDS WANTED

GEORGE GILMER, *Virginia*

The midseason yellows of all shades have been developed so far that there appears to be little hope of great improvement in them, except by developing new forms. However, there is much room to improve early and late yellows.

I now have a new midseason yellow on test before introduction for a hybridizer which is triangular in shape. Every visitor has been pleased with it. Some say it looks like a Japanese iris but most say it looks like an orchid. It is a decidedly more distinct break in form than Wau-Bun but very compact with large broad curled petals. When released it should be used to breed a new type of all colors, early midseason and late. The Wau-Bun type is now available in Taruga, a little light yellow, Theodore Mead, a deep golden yellow, and Rose Gem with rosy petals. I have not seen that type of bloom in any pinks or reds and in no very early or late yellows.

Midseason reds have been greatly improved in the last five years. For some ten years Vulcan was my best red. Now there are at least a dozen better. There are yet few good early and late reds.

There is much chance to improve pinks of all shades. Most of them fade in the afternoon sun. Most have narrow petals. We need fadeless pinks in a variety of shades and broad petals, long twisted petals like Wau-Bun and triangular shaped flowers blooming early midseason and summer.

So called purples have been on the market for years. Of these the nearest true purple I know is Purple Waters. It needs more blue to be a true purple. I have one on test for a friend that in the early morning is a true purple—a dark rich blue purple like a pansy, a truly remarkable break in color but the blue fades. It is a wonderful stepping stone to new and finer purples.

There are a lot of good bicolors. The possible combinations of colors are endless. There are also charming blends. How many more are possible no man knows.

Many of the plants I hope others will create may have been already produced. I have tried to get from ten to thirty of the new best ones annually. But no man can keep up with all of the new ones registered unless he has practically unlimited money and plenty of time.

CROSSING POETAZ **NARCISSUS**

W. R. BALLARD, *Maryland*

Among the older varieties of *Narcissus* which I have had naturalized for several years are a number of clumps of Poetaz varieties, mostly Elvira, but also including one or two others not markedly different in appearance. I have never been successful in getting seed to set on these varieties, so I decided to try pollen of these on other types. Beginning in the spring of 1943 and every year since I have tried various combinations. Some of these have been repeatedly made. I have now piled up quite a respectable list of varieties which, under my conditions, have consistently failed to set seed.

These varieties are: Ada Finch, Beersheba, Ben Hur, Bodilly, Cheyenne, Daisy Schaffer, Dawson City, Firetail, Forerunner, Gallipoli, Golden Beauty, Golden Perfection, Golden Queen, Golden Sunrise, Great Warley, John Evelyn, Lady Hillingdon, Lovenest, Lucinius, Mayflower, Moonshine, Mrs. R. O. Backhouse, *Odorus gigantea*, Porthilly, Robinhood, Roxane, Sheresade, Shot Silk, Silver Salver, Sonja, Suda, Sunrise, Thalia, Tresserve, Tunis, Whiteley Gem.

On the other hand I have had one wee bit of encouragement. In the spring of 1947 four flowers of Salemba were pollinated. Three of these developed pods and from these 23 seeds were harvested. Again in 1948 this cross was repeated. Eleven flowers were pollinated, three pods developed and 26 seeds were secured.

I still have a number of combinations which I plan to make using these Poetaz varieties as the pollen parent. I am hoping to find other congenial crosses to add to the one success so far.

It is quite possible that pollen from other varieties of the Poetaz group would give more promising results but I have not tried them. If the pleasing fragrance of some of these varieties could be added to other types, it would be quite an acquisition.

FURTHER INFORMATION ON THE GENETICS OF PINK DAFFODILS

(a) FOREWORD

EDGAR ANDERSON,

*Geneticist to the Missouri Botanical Garden, Englemann Professor in
the Henry Shaw School of Botany of Washington University.*

Mr. Guy Wilson, in the accompanying note, has filled in the preliminary account which Earl Hornback and I put together several years ago. In it we showed from data taken in the De Graaff breeding plots, that in daffodils the pink tone of color (but not color itself) was linked with narrow perianth segments and a narrow, straight-edged crown. As the result of this demonstration we postulated that the pink daffodils are recombinations of brightly colored cups from *Narcissus poeticus* with a pink color tone from some other ancestor with a narrow trumpet and a floppy, poor quality perianth. Since we observed an occasional sepia-pink browning in aging *N. moschatus*, we suggested that this species might be the source of the pink tone, a suggestion which came the more readily since we knew *N. moschatus* to be in the ancestry of several plants which had given pinks.

Mr. Wilson now points out that *N. muticus* also fulfills these same conditions and is also known to have been in the ancestry of some pink daffodils. He suggests that the pink tone may have come from *N. muticus* (= *abscissus*) or from both *N. muticus* and *N. moschatus*. On the basis of my limited knowledge I would suspect the latter hypothesis to be more likely. *Narcissus muticus* and *N. moschatus*, according to Barr, both come from the Pyrenees. Since they have the same general trumpet shape it would be highly probable, coming from the same area as they do, that they have many other genes in common, including the basic factor for pink color tone. On a white background, with few genes for color, (as in *moschatus*) this would give us a white flower, faintly tinged with sepia-pink as it fades. On a strong yellow background, (as in *muticus*) it would give us a yellow trumpet, distinctly buffy on the inside.

From the pedigrees listed by Mr. Wilson, and the additional information contributed by Earl Hornback and by Jan De Graaff it will be seen that each of these species is known to have entered into the ancestry of many of our pink daffodils. While none of the pedigrees gives us undisputable evidence either for or against any particular hypothesis, they all agree with the postulate that brilliant color comes in from *N. poeticus* and that pink color tone is supplied by *N. muticus* and *N. moschatus*.

(b) COMMENTS ON MESSRS. ANDERSON & HORNBACK'S
GENETICAL ANALYSIS OF PINK DAFFODILSGUY L. WILSON, *Northern Ireland*

The AMERICAN PLANT LIFE SOCIETY has asked me for comments on a pamphlet entitled "A Genetical Analysis of Pink Daffodils" by Edgar Anderson and Earl Hornback. I had already received this pamphlet from a Canadian correspondent to whom I wrote a letter of comment, a copy of which I sent to Mr. Jan De Graff, of the Oregon Bulb Farms, asking him to pass it on to Mr. Hornback. Much, though not quite all of what I shall say now was contained in that letter.

I don't feel fully convinced that the authors of this paper are entirely right in their deduction that the original source of pink colouring is *Narcissus poeticus* and *Narcissus moschatus*. It may well be one source, but actually I think that *Narcissus abscissus* or *muticus* is just as likely to be an original source as *N. moschatus*. Of course I think that the red colouring originating in *Narcissus poeticus* and diluted by successive generations of breeding with other species and hybrids especially white things, is still probably the major ingredient of the tints of pink that we now see in recent hybrids, but it seems to require combination with some other factor or factors to develop it or bring it out, and I think that *N. abscissus* probably contains one of these factors. *Narcissus abscissus* or *muticus* is of course a wild Perynean yellow trumpet. It has a peculiarly narrow straight sided smooth edged stove pipe type of trumpet, and nearly always a rather narrow and poor perianth; Messrs. Anderson and Hornback observe that it is clear that pink is linked with these factors, which however in their consideration of the subject they doubtless trace to *N. moschatus*, but they can equally be inherited from *muticus*, or perhaps from a combination of both. I manage to get a few blossoms of the wild *N. moschatus* here every spring, but have never noticed the faint tints of pink or light purplish brown as the flower fades, which Messrs. Anderson and Hornback have attributed to it, but what appears to me most significant about *N. muticus* is that there is a trace of buffness in its yellow colouring. Another distinct feature about *N. muticus* is that the plant has broad flat foliage quite distinct in character to the narrow foliage of *N. moschatus* or of other wild trumpets such as *N. hispanicus maximus* and the various forms of *N. spurius*. *Narcissus muticus* is, of course, somewhat variable as are others of the wild species. Many years ago the late Henry Backhouse, brother-in-law of the late Mrs. R. O. Backhouse of Sutton Court, Hereford, and son of William Backhouse of early Daffodil fame, sent me a few bulbs of a broad petalled form of wild *N. muticus* which he had himself collected in the Pyrenees. I raised a few seedlings from this and the warm buff tone was quite apparent in their colouring.

I am inclined to think that the bicolor trumpet Weardale Perfection is one of the principal ancestors of pink crowned things. Weardale Perfection has just a trace of warm creamy buffness in the pale yellow of its trumpet, and I think also in the white of its perianth, which is

noticeable when compared with other more clear toned flowers. I speak from memory as I have not grown it for many years, but I remember being very definitely aware of this. I have no idea how Weardale Perfection was bred, but think it very probable that its pedigree would go back on one side at all events to *N. muticus*. The Leedsii variety Lord Kitchener was bred by the late Mrs. R. O. Backhouse from the old Leedsii Minnie Hume by Weardale Perfection. Lord Kitchener in its time was well known as a quite remarkable seed parent for giving pink crowned things. The first outstanding one that I remember appearing was a flower called Miss E. M. Bowling, which was shown by Mr. W. B. Cranfield at the MIDLAND DAFFODIL SOCIETY many years ago and there caused a great sensation as it was, for those days, a good flower with a well built perianth, while the crown had a very distinct and well defined pink frill. This flower came from Lord Kitchener by pollen of another white or almost white Leedsii named Anthea, of which I do not know the breeding. Mr. Cranfield's bulbs subsequently suffered from a bad attack of eelworm before the control of this pest was understood, and he most unfortunately lost the entire stock of Miss E. M. Bowling. The well known variety Suda came from Lord Kitchener by pollen of Nevis, and there have been others from Kitchener which I cannot at the moment recall.

The writers of the pamphlet say that Will Scarlett is known to be one of the parents of the pink crowned Mrs. R. O. Backhouse. I have heard that Mrs. R. O. Backhouse was bred from Lord Kitchener by Will Scarlett, but do not know whether this has been definitely confirmed, but I think it quite probable. Now Will Scarlett was bred from *N. muticus* by pollen of *Narcissus poeticus* Poetarum, so if my guess is correct that *N. muticus* is somewhere behind Weardale Perfection, the Pink Leedsii Mrs. R. O. Backhouse has a double dose of *N. muticus* in its ancestry. Of course Minnie Hume, the mother of Lord Kitchener, must almost certainly trace back to *N. moschatius* on the white trumpet side of its pedigree.

I can recall that years ago when I grew Weardale Perfection I had a few very rich self yellow trumpet seedlings from it. I cannot recall their pollen parent or parents at the moment, but I clearly remember that several of them showed a very distinct deep rather old gold or orange rich tone of colour due to this underlying buffness. As they were not very good flowers I have long since discarded them.

I have often said that on the whole I think it was a pity that Will Scarlett ever appeared, as it transmits bad faults to successive generations of its descendants, one of which is muddiness of colour, especially in the perianth, which of course traces back to the rather muddy yellow of *N. muticus*. This fault is not always apparent but in the case of many of the things with highly coloured cups which are descended from Will Scarlett it is there.

One of the first slightly pink toned things which Engleheart produced was a thing called Rosary; the small original stock of this he sold to the late Brodie of Brodie. This flower was practically a trumpet with white perianth and the trumpet very slightly flushed with warm

shell pink. I don't know how it was bred, but should certainly guess Weardale Perfection to be behind it. I think Engleheart used Weardale Perfection and probably also Lord Kitchener. Weardale Perfection had a tendency to a mild form of virus or mosaic which showed as a faint striping in the foliage. Rosary is also very prone to this. Rosary has the *N. muticus* type of foliage, rather than the *N. moschatus* type. Weardale Perfection had also broad foliage. Mr. C. E. Radcliff of Hobart, Tasmania, who at the moment I think probably leads the world in the production of pink crowned Daffodils, has I know made fairly extensive use of Rosary in the earlier stages of his breeding. I have several of his pinks here, such as Pink O'Dawn, Dawnglow, Rosario, and one or two others of more or less trumpet type. They all have the broad type of foliage. Dawnglow, which was a cross between Rosary and Pink O'Dawn is a bicolor trumpet, with a very strong buff tone, whilst Rosario, which was bred from a Leedsii named Pinkie by pollen of Rosary is a really lovely flower of trumpet character, with pure white perianth of good breadth and quality, the ground colour of the crown being cool pale primrose overlaid and flushed throughout with delicate and real rosy pink. These things are scarcely long enough established here to estimate their true character. Dawnglow seems to show a faint mosaic like Rosary and is extremely slow of increase. Rosario so far seems a definitely better doer.

One of the brightest and purest bits of pink we have yet seen is the little flower Wild Rose which was bred from Mitylene by pollen of a white Leedsii of my raising named Evening. Evening is descended from a large white Leedsii of Engleheart's raising three generations back. Engleheart's flower may well have had Weardale Perfection somewhere behind it. I have had one or two quite strong pink cups out of Mitylene by Evening myself and others out of White Sentinel by Evening. Engleheart raised Mitylene and White Sentinel from the little old Barrii Beacon (which gives such remarkable seedlings) by pollen of some large Leedsii. A plant geneticist who corresponds with me has made a guess that the other parent of Mitylene may quite likely be Lord Kitchener, but I don't know that this is confirmed. He thinks that the other parent of White Sentinel is not the same as that of Mitylene.

There is quite a nice flower named Rose of Tralee raised by Mr. J. L. Richardson of Waterford. This came from White Sentinel. Mr. Richardson thinks it to be self fertilized White Sentinel, but of course a grain of pollen may have reached White Sentinel from some other source. Rose of Tralee develops quite a nice pink, but it fades out white in the end. Last spring Mr. Richardson showed a really remarkable fine pink crowned flower of excellent form and very smooth quality, the crown being a definite uniform pink throughout, which he said came from self fertilised Rose of Tralee.

Another thing occurs to my mind. In early days there was a little white trumpet named Apricot, which was quite a small flower and I think had a fairly straight smooth edged trumpet, definitely flushed with apricot colour. This variety appeared I believe about the same

time as Madame De Graaff or perhaps earlier, and I rather think its originator was the original firm of De Graaff in Holland at that time. I have no clear recollection of it as I never grew it, and I think it had a poor constitution, but I can dimly recall seeing it more than once in an exhibit put up by Messrs. Barr and Sons of Covent Garden, London. I have sometimes wondered of late whether it could have been a cross between *N. moschatus* or one of the old white trumpets that are closely allied to *N. moschatus*, and *N. muticus*. I have never heard that anything of interest has been bred from it.

The question has been asked as to which crosses have given me pink Daffodils. I fear it would take too much time and space to trace all these as I have had quite a number. A few, however, may be mentioned, e. g. Mitylene x Evening and White Sentinel x Evening. One of my best a few years ago is Lisbreen, which came from Mitylene x Evening. I have had flowers with deeper colour than either parent bred between Pink O'Dawn and Lisbreen. White Sentinel x Wild Rose; Rose of Tralee x Evening, and Rose of Tralee x Wild Rose, fairly strong colour (but form not quite good enough. Of course only small batches were raised. Nautilus (Radcliff) x Carnlough. Suda x Evening. Clava x Evening. While a large Leedsii which is the grandchild of Fortune, mated with such things as Evening has given some pinky crowns. Cushlake, a quite small 4-B Leedsii which is a seedling from Brodie of Brodie's tiny Fairy Circle which has a little pinky orange rim, was crossed with Brodie's Leedsii Dava (Bred from Leedsii Kingdom by White Emperor). From this cross, i.e. (Cushlake x Dava) I got a thing I call Interim, which is a vigorous decorative type Leedsii with a very strongly marked salmon pink rim.

Unexpectedly my giant white trumpet Broughshane appears to carry some factor for pink, as when I used its pollen on a Dutch Leedsii called Gracious, amongst the resulting batch of seedlings there came several with a good deal of quite strong pink in their crowns, but they lacked other good qualities. I also had a large seedling from the little 4-B Silver Coin by pollen of Broughshane, which showed a definite tint of pink at the frill of its wide crown, but as it was an ill balanced flower I did not keep it. Broughshane of course has Weardale Perfection in its pedigree. An even more surprising flower came in a batch of seedlings bred between Trostan (The mother of Broughshane) by pollen of the white trumpet Beersheba. This unexpected flower had a pure white perianth and a full trumpet which is pale pink throughout, a rather poor and muddy pink, but quite definitely pink. I fancy that Weardale Perfection is behind Trostan. I know that Beersheba came from White Knight, but don't know the other side of its pedigree. A good many years ago I raised a seedling, No. 18/130. This came from a white trumpet Leedsii by pollen of Engleheart's large tall Leedsii Tenedos. It was a large white flower, which developed a quite strong tint of very pure rose pink in the crown, but as this faded out very quickly after being visible for only a day or two, I did not keep it. I have heard from other raisers that Tenedos has given tints of pink. It is thought that Tenedos has probably got Weardale Perfection in its ancestry.

(c) COMMENTS ON ORIGIN OF PINK DAFFODILS

EARL HORNBACK, *Oregon*

I am inclined to agree with Mr. Wilson that the case is not proven. The only way to prove it would be to make direct crosses between *Narcissus moschatus* and *N. poeticus* species, and even if this failed to produce pink nothing would be decided, as some other factor might be suppressing the pink.

I have never agreed entirely with Dr. Anderson's theory, because too much is taken for granted and not strictly proven—of course the article was not intended to be the final word on the subject as shown in its title by the use of the word "preliminary." While Mr. Wilson presents a strong case for *N. muticus*, he does nothing to disprove Dr. Anderson's theory either. In other words, it would be impossible to prove beyond doubt that *N. moschatus*, *N. Poeticus* and *N. Muticus* are not all concerned in the ancestry of every pink daffodil in existence at the present time. The only possible way to settle this question would be to produce pink from species crosses.

Personally, I would relegate the whole question to the realm of minor matters and take up some more important phases of the pink daffodil problem.

First, the existence of a gene or genes carrying "pink" as a definite color seems to me to be adequately proven. That we are dealing with only one "pink" whether we refer to Wild Rose, Mrs. R. O. Backhouse or Lisbreen seems quite clear to me. We have grown about ten thousand seedlings with Mrs. Backhouse as the male parent, and have seen seedlings of every shade and variation of pink that occur in any named varieties, and some shades that do not. It seems obvious that all these different variants of color are due to the influence of the same gene, or genes.

Second, the influence of other factors on the pink coloring, the principal one being yellow coloring. Practically all pink cups also contain more or less yellow, which in some cases must fade out somewhat before the pink is visible at all. The so called "muddy" pinks are an example of a yellow that does not fade sufficiently. If the yellow in the cup is a bright, or non-fading yellow the pink may be unable to show at all, though it be present. Less often we see some red in the combination, giving glowing apricot-orange shades. There are probably dozens of other factors, of which we know little, that modify the pink coloring.

Third point of interest is that the pink occurs principally on the inside of the cup. To show it to best advantage, then we should breed for wide cups more than trumpet types.

Fourth, regardless of the original source of pink there is a definite linkage with several characteristics usually referred to as undesirable. These are, narrow perianth segments, poor substance, short stems and straight cups. While we have been able to overcome these difficulties singly, they have never been overcome as a group in any single plant to the extent that they have in other groups of *Narcissus*.

The above points seem to me to be of much greater importance in breeding pink daffodils than finding their basic ancestor. For all we know *N. moschatus* and *N. muticus* may be descended themselves from a common ancestor, or perhaps one is the ancestor of the other.

Another very interesting thing about pink daffodils is in their resistance to common mosaic. Most varieties show about the same degree of resistance as *N. poeticus*; the virus appears in a mild form and spreads very slowly, or in some cases does not appear at all. The exceptions to this rule however, show the disease in a violent form and the spread is very rapid. A few show a mild form with rapid spread (mostly Rosary and descendants) or the violent form with slow spread. This gives us

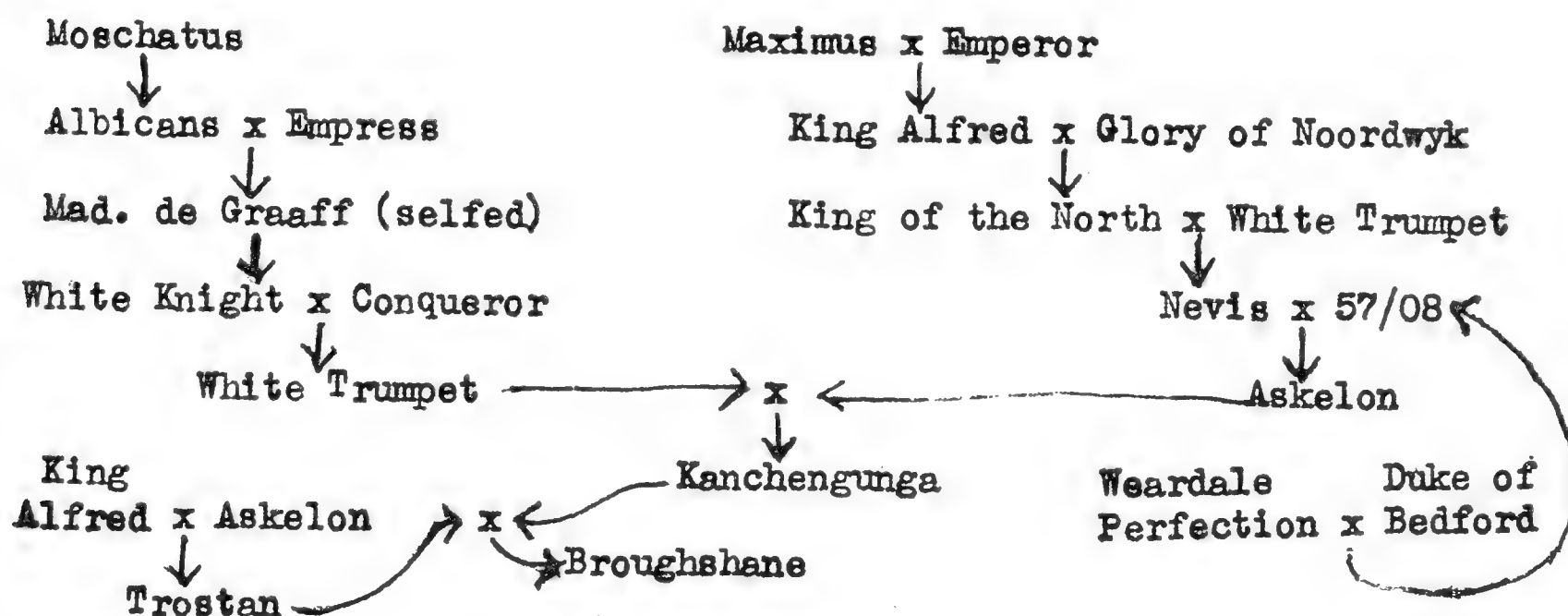


Fig. 200. Pedigree of hybrid *Narcissus*—Broughshane

one more link with *N. poeticus* but does not indicate much concerning the other side of the family tree.

One real exception I have to take with Mr. Wilson's remarks is his though that "pink" in daffodils must be a dilution of the red occurring in *N. poeticus*. If this were true we should get some red cups from crossing two pink varieties. This has never happened to us. Instead pink x pink gives a high percentage of pinks with the balance of the seedlings mostly pale yellow. Probably if we had really pure pinks to breed with, I mean pinks without the yellow coloring in combination, pink x pink would give one hundred percent pink.

N. muticus = *N. abscissus*, a bicolor of strongly contrasted white perianth and yellow cylindrical trumpet, and quite unmistakable because of its "clipt" appearance of trumpet. Mostly unmixed with other trumpet forms and does not vary a great deal.

(d) NOTES ON THE ORIGIN OF PINK DAFFODILS

JAN DE GRAAFF, *Oregon*

As to the parentage of some of our old daffodils, originated by my Grandfather: Apricot is *N. absissus* (*muticus*) x *Albicans*, and *Albicans* is again a seedling from *Moschatus* so that does not bring us much further. Apricot was still grown in Holland until a few years ago and I have a few bulbs of it here, still vigorous and healthy. We had another one in the old days, called Watteau.

From Apricot we raised one called "Rosy Trumpet" and this is still in cultivation in Holland and here. It is a deeper pink but has lost substance. Then there is a group raised from seedlings like Rosy Trumpet, things such as Rosabella and Sublime. All of them have the strong admixture of yellow with the pink and they are more salmon or buff than pink in coloring.

I have just looked up the pedigree of Broughshane (Figure 200).

And Broughshane gives pink trumpets in its offspring and one could, I suppose, make a case for either *N. absissus* or *Moschatus* as the one carrying the pink gene or perhaps both.

3. AMARYLLID CULTURE

[REGIONAL ADAPTATION, SOILS, FERTILIZATION,
IRRIGATION, USE IN LANDSCAPE, DISEASE
AND INSECT CONTROL, ETC.]

NOTES ON AMARYLLIDS CULTIVATED IN THE TRANSVAAL

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There is still a great deal to be learnt about the cultivation of *Amaryllidaceae* in the Transvaal, particularly those which are introduced from other Provinces, where they grow under rather different climatic conditions. In spite of the difficulties it has been possible to grow a number with satisfactory results. The genera will be dealt with in alphabetical order.

AMMOCHARIS CORANICA

This has a very wide distribution and is to be found in most parts of the Transvaal. The plants grow in colonies or singly, mostly in flat open country amongst grass in sandy red or black loam, which is usually very firm around the bulb. The photograph (Fig. 201) gives an idea of their habit of growth. The leaves differ a great deal in length, depending on the moisture content of the soil. In wet seasons the leaves are much longer and more luxuriant, whereas in dry seasons they shrivel up and disappear entirely during winter. During the past season *Ammocharis coranica* has been in full flower due to good general rains, and seeding has been prolific. Seed germinates readily but the bulbs take from four to six years to come into flower under cultivation. Apparently only a relatively few seedlings come to maturity in the veld as one finds mainly full-grown bulbs.

AGAPANTHUS

The species of *Agapanthus* may be divided into two groups:

- (1) Evergreen (*Agapanthus africanus* falls under this heading.)
- (2) Deciduous (*A. campanulatus*, *A. longispathus*, *A. inapertus*, *A. pendulus* and some others fall under this heading.)

(1) *Agapanthus africanus*. This is known throughout the world. It is interesting to know that bulbs of it were exported from the Cape Peninsula in the early 17th century for cultivation in Europe and from there they were re-exported to other parts of the world and even back to South Africa. To-day one sees few gardens without a clump of *Agapanthus* and often they are used along borders with striking effect. With good soil, sufficient nourishment and water, good results are had in a short time without trouble. Each young growing-point usually gives

one flowering stem, with the result that a mass of blue is to be had in the summer months from November to February. The white variety is not so common. By horticultural selections dark strains with a longer flowering period have been segregated.



Fig. 201. *Ammocharis coranica*, growing in marginal Karrooveld near the Orange River, Orange Free State. Photo by L. E. Codd.

(2) The deciduous species of *Agapanthus* are found on mountain ranges of the Transvaal and Natal. The conditions are generally very moist, with a dry period during the winter months. The plants occur mostly along streams, among rocks and in tall grass. They have smaller flowers than *Agapanthus africanus*, but the inflorescences are usually taller and the colour of the flowers is often darker, up to a very dark purple. All deciduous *Agapanthus* thrive in a good well-manured soil, with sufficient water during the growing season and a rest during winter.



Cyrtanthus sanguineus as grown by A. H. Crundall, Umlaas Falls.

Photo by H. King.



Crinum crispum in its native habitat on Thornveld on black clay soil, beside Pienaars River, District Pretoria. Photo by Dr. L. E. Codd.
Plate 324

BRUNSVIGIA

This genus has so far not been cultivated to any great extent in South Africa. The reason is not yet clear. Although some species of *Brunsvigia* occur in rather dry areas, it seems that they generally require a fair amount of rain before flowering. They grow under varying habitat conditions. Some grow in the open, others are wedged between rocks, while yet others grow on mountain slopes in almost inaccessible places, where they are largely sheltered from the direct rays of the sun. Those growing on moist mountain slopes grow in a firm but well drained mixture of fibrous grass roots, soil and leaf mould. Others grow in hard clay or stoney soil. Possibly conditions of cultivation will have to be varied according to the origin of the particular species. As a preliminary trial, however, species of *Brunsvigia* at this Division are being grown in a mixture of four parts garden loam, one part coarse sand, one part peat and one part compost. They are doing well so far, but it is somewhat too soon to say what this mixture is the best one for all species.

CYRTANTHUS

The genus *Cyrtanthus* is a large one and it has been found that *Cyrtanthus mackennii* (IFAFA LILY) and its varieties are by far the easiest to cultivate. They flower here in late winter or early spring and with a little attention give very pleasing results. They grow best under partial shade and flower freely under these conditions. Most *Cyrtanthus* can be propagated from seed, but *C. mackennii* can best be increased by division, as the bulbs multiply considerably. Too frequent transplanting of *Cyrtanthus*, however, does them more harm than good and it has been found that they flower more regularly if left undisturbed. It is essential when transplanting *Cyrtanthus* that the soil around the bulbs should be thoroughly firmed. This applies rather generally to all *Amaryllidaceae* bulbs. Other *Cyrtanthus* bulbs which have been grown at this Division are *C. contractus* and *C. sanguineus* of which a photograph is included (Plate 323). Generally speaking *Cyrtanthus* requires a moist well-drained sandy loam. The summer flowering species should be planted May to August and the autumn flowering varieties should be planted from January to March in southern hemisphere. The plants should be watered freely during dry summer weather, but it is advisable to withhold water when the bulbs are dormant.

CLIVIA

The genus *Clivia* produces some of the showiest flowers of all and although quite easy to propagate, it is shy to flower if not properly treated. *Clivia miniata* grows well here in a shade house or under trees, but it has been found that much better results may be obtained if plants are kept under glass in a more humid atmosphere. The plants are normally grown pot-bound in 6"—9" pots in a mixture of sandy loam enriched with well decayed manure. During the growing period plants should be watered freely and an application of liquid manure once per

month will prove beneficial. *Clivia miniata* and its cream form var. *flava* are the most attractive to cultivate. Sometimes one may find clumps of *clivia miniata* growing at private residences in half barrels or in Alibaba jars with some protection from trees or a verandah. It is a wonderful sight to see as many as twenty flower heads together. The plants are so tight together in the barrels or jars that it is impossible to get any out without breaking the container.

The other *Clivia* species such as *C. nobilis*, *C. gardeni* are interesting botanically but are not to be compared with *C. miniata* and its hybrids as far as their beauty is concerned.

CRINUM

The *Crinum* species grow very easily and practically under any garden conditions, except for *C. campanulatum*. This grows naturally in shallow pans in the Cape, and does well in permanent water under cultivation.

The *Crinums* are best propagated from seed, which is very fleshy and should be sown shortly after harvesting. They prefer a good sandy loam in a moist position, and in the open as much as possible. The sowing of seed depends on the time they flower, and as they flower mostly during the summer months, from December to February, one may expect to sow seeds during February to March. They germinate quickly and it is important to keep the young seedlings growing as long as possible during autumn and early winter, so that they can form proper bulbs before the resting season.

With some species in their natural conditions the bulbs may be underground up to 18" to 24" and if the soil is hard it is quite a tiring job to dig them out. The photograph (Plate 324) shows *Crinum crispum* growing in its natural habitat about 45 miles north of Pretoria in thornveld in clay soil beside the Pienaars River. Plants at present under the name *C. forbesianum* grow near Pretoria in grassveld in sandy soil and flower during February. The leaves lie flat on the ground and when not in flower are quite difficult to find.

HAEMANTHUS

The *Haemanthus* species grow under varying conditions from cool inland mountain slopes to flat dry Karoo and sandy coastal regions, but under cultivation it has been found that they do well in almost any kind of soil provided the plants are in the shade. The soil should preferably be enriched with well decayed manure. The bulbs should not be watered during their dormant season, that is, water should be withheld when the leaves turn yellow until the new ones appear in spring.

There are many different species and most of them are attractive, but the most outstanding are *H. katherinae*, *H. magnificus*, *H. nelsoni*, *H. coccineus*, *H. hyalocarpus* and *H. puniceus*.



Nerine falcata: Bulbs are 6 years old from seeds, and have been flowering for the past 4 years. Original bulbs from Skaapkraal. Photo by R. A. Dyer.



Sprekelia formosissima under cultivation at Pretoria, South Africa. Photo by R. A. Dyer.

NERINE

Very little difficulty has been experienced with the growing of *Nerines* and the attached photograph (Plate 325) of *N. falcata*, six years after having been sown from seed in the open, is a good example. *N. falcata* has reddish flowers which form a large umbel and they commence to flower during January. Bulbs begin to flower 3-4 years from seed.

Nerines require a light sandy soil to which some well decayed manure has been added. They prefer sunny position, but require ample moisture during their growing season. *Nerine* seeds are first sown in beds soon after harvesting, as they practically germinate on the plant. They are left in the seed bed until about November-December, when they are pricked off into another bed, and are then spaced from 3-4 inches apart. In this position they remain for three or four years before being replanted again into their permanent position.

Nerine filifolia and *Nerine angustifolia* are extensively used as cut flowers and it is quite common to see them being sold by street vendors in different parts of the country. *N. flexuosa*, *N. krigei*, *N. bowdeni* and *N. laticoma (lucida)* are easy to propagate and offer no difficulties. *Nerine filifolia* may also be propagated by dividing the old clumps which produce quantities of young offsets every year.

TULBAGHIA

T. fragrans and *T. violacea* are the two most commonly cultivated species of this genus, common in this respect, that they are mostly cultivated in Government or Municipal gardens or parks. There are several other species but they are mostly of little value as ornamental plants. *Tulbaghia fragrans* commences to flower during August after the leaves have been completely cut down by frost, and the clumps reach their flowering peak towards the end of September, while they may continue to produce some flowers during summer and in autumn. A small flush of flowers often appears during March-April. *T. violacea* flowers later than *T. fragrans*, i.e. during October, but the garlic smell of this particular species restricts its usefulness.

Tulbaghias seem to appreciate a loamy soil into which a fair amount of well decayed compost or manure has been worked. During their growing period they should be watered freely but may be left completely dry during winter. *Tulbaghia* prefers the open sun to shady positions. They increase rapidly and are best propagated by division of the crowns. They seem also to prefer the open ground rather than the restricted space of pots. There is no particular time that they should be divided, but it is preferable to it after they have flowered in spring, so that strong new roots may form before the next season. A single plant of *T. fragrans* may increase into a clump 12"-18" across in 3-4 years, which is sufficient evidence of its vigour and hardiness.



An amaryllid of the Tribe *Zephyranthaceae*, probably *Habranthus robustus*, cultivated at Pretoria, South Africa. Photo by R. A. Dyer.
Plate 327

VARIOUS AMARYLLIDS

The foregoing paragraphs have dealt with a few South African species of *Amaryllidaceae* successful in cultivation. There are many more, such as those belonging to *Anoiganthus*, *Pancratium*, *Buphane*, *Hessia* and *Gethyllis*, which have been grown, but which for various reasons have not persisted. There is not always an early opportunity for reintroducing them for further trial. In many cases one can only find bulbs when in flower (which is a bad time for transplanting) for example *Pancratium chapmannii*, which grows under very sandy conditions on the edge of the Kalahari desert.

INTRODUCED AMARYLLIDS

Some introduced *Amaryllidaceae* do well in the Transvaal and the accompanying photographs (Plates 326 & 327) of *Sprekelia formossima* and an amaryllid of the Tribe *Zephyrantheae*, grown in the open, are a fair indication that these bulbs have quite adapted themselves to our conditions.

In conclusion, I would like to mention that comparatively few of the South African bulbs are grown on a commercial basis. Their cultivation is mainly in Municipal and Government controlled gardens where they are propagated on a small scale for ornamental or scientific purposes. Where they are offered for sale in commerce it is sometimes doubtful whether the bulbs have been grown from seed or whether they have been robbed from the veld.

Experience indicates that the majority will germinate and flourish from seed and it seems that a demand for plants could be stimulated and that there is a good commercial field awaiting development.

SOUTH AFRICAN AMARYLLIDS AS HOUSE PLANTS

SARAH V. COOMBS, *New York*

This article is written with just one object, the hope that it may induce someone who loves beautiful flowers and is willing to work for that beauty, to try some of the South African Amaryllids. They are a gorgeous group, many brilliant in color, some heavy with perfume, some interesting in form and all with the power to give pride to the people who can grow them. Many of them are not easy to grow or rather, they need a rather simple but definite form of cultivation. Many have had almost no word of their culture to pass on, yet it is always a great day when a lovely *Crinum* blooms for us, when the gold-dust strewn *Nerine* sends up its scarlet-tinted flowers, when the *Cyrtanthus* expresses its appreciation of our care, when the odd *Haemanthus* puts up its startling brush, looking, when one comes on it suddenly in its native land, like a snake's head lifted in surprise.

The marvellous hybrids, raised or imported for us by our firms with a vision, show what we may hope for. Should we not be selling that second loaf (they sometimes cost a good many loaves) and going without that mundane luxury we had meant to buy, to possess one of them. Their very names sound exciting: *Brunsdonna*, a hybrid between *Brunsvigia Josephinae* and *B. rosea* (Syn.—*Amaryllis belladonna* Ait., non Linn., or *Callicore rosea*), *Crinodonna Corsii* (Syn.—*Amarcrinum Howardi*), the FIRE LILY, the SCARBOROUGH LILY, the KEI LILY, the CANDELABRA FLOWER, etc. Some of the hybrids have been crosses back and forth and are to be had in this country.

Some obligingly grow easily. Some are apparently cranky. They come to us with the one label,—“From South Africa.” Yet should we expect small alpinists from Alaska to like the same conditions of soil and heat as the BLUEBONNETS of Texas or the cacti of the high desert tablelands. We must learn from anyone who has been successful with these treasures. Beyond that we must learn where they grow at home. Some come from the temperate Cape Province, where the rains come in their winter, and are followed by the dry hot summer. Some come from Natal Province, far up the eastern coast, where a tropical arm seems to come down from the Equator, so that many of the flowers can stand much heat. In that section and in the Transvaal, the winters are dry and the heat grows greater in the early summer, till it breaks into the heavy rains. No, it isn't always easy to grow them but is that any reason for not trying some of them? We must learn all we can about them and then go ahead.

To spread out all their faults at once, some of them have a slowness in blooming. Dr. R. A. Dyer of Pretoria, Botanist of the Division of Plant Industry of the Department of Agriculture and Forestry, Union of South Africa, says in HERBERTIA, Vol. 3, (1936): “Most species of *Crinum* share the horticultural disability of a protracted juvenility,” not a very cheerful outlook, yet he says also in the same article: “South Africa has been endowed by nature with a very rich flora in which *Amaryllidaceae* occupy an important position. Many of them were introduced to European gardens during the 17th and 18th Centuries. Some belonging to the genera *Nerine*, *Haemanthus*, *Cyrtanthus*, etc., have remained favorites ever since. Enthusiasm for their cultivation locally increases annually.”

There are records for faithfulness in blooming hard to beat. This writer, for example, was given well over thirty years ago, a large bulb, called in Vermont, where it had its abode, the “MEXICAN LILY.” It soon proved to be, not a *lilium* nor from Mexico, and when it bloomed, was named at my request, by the New York Botanical Garden, *Crinum Moorei*, from South Africa. This particular one is white with a tinge of pink. After its prompt blooming it produced several children, one of which, with its parent, has bloomed every year since, without a single omission for over thirty years. That is a record of faithfulness. The two have also provided bulbs for many friends, whose bulbs have likewise bloomed steadily.

The following is a matter of note. Bulbs of this species bloom at almost any time. In Vermont they spend the winter in their tubs in the cellar and bloom on the veranda in summer. The bulbs I mention above, bloomed in a small coolish greenhouse in late January or early February. In a heated sunroom they bloom in late February and March and in an unheated enclosed sleeping-porch, they come on a month later.

The above is like a text to me. Though I may tell of bulbs with too early bloom or too late bloom to be really house plants, by treating them in different temperatures, they or their hybrids, will many of them adapt themselves to current conditions. In a June number of a well-known flower magazine the writer tells of the blooming time of *Gloriosa Rothschildiana* (*Liliaceae*). He says: "Apparently it can be brought into flower at almost any time of the year." He has seen it in an orchid house on Christmas Day, in a conservatory flower-show in mid-April and in June blooming in a big glass house. I know they bloom out-of-doors in the New York Botanical Garden in summer.

The seasons, of course, in South Africa are the opposite of ours. Many of the bulbs bloom outdoors here in their fall and winter months. We cannot just say that we can duplicate the conditions of heat and soil. It is not quite as easy as that with differences in sunlight, yet constant experiments will bring us great knowledge of the cultivation of these splendid plants.

South African Amaryllis do not require a very rich soil. They enjoy extra fertilizer and doses of liquid manure and, of course, exhibition types need extra care but they will do pretty well even in an ordinary soil. Two things they must have,—all the sunlight you can give them (with some exceptions), and a time of resting. Even where the bulbs keep their leaves, growth is checked for a time. Bulbs which lose their leaves after blooming by drying off may be laid on their sides in their pots under a bush in summer and forgotten. If in a green-house, a covering of salt hay over the pot or laying the pots on their sides will bring them through the hot temperature.

It has been this writer's experience that a small amount of water is better for them at such a time than "bone-dryness." Even in South Africa's summer, there is an occasional storm. While they live through complete dryness, they do better if it is not quite complete. There are two opinions about this.

Cyrtanthus will like more water in growing than most of the bulbs. They grow in moist places, near streams and in high elevations, where they have cool, damp night air.

Seeds need a large proportion of sand in their soil, probably two thirds at the start. Drainage must be perfect. Later, a good garden soil will be right but always with the good drainage. It is possible to overdo the sunlight with young plants. They must be watched. Once well-grown, with care in drainage, much water when blooming and withholding it gradually as they stop growing, they will do well. When they reach mature growth, they will stand a good deal of indifferent treat-

ment without resenting it, though thankful for extra kindness. An amiable lot, really, when a few necessities are looked after.

Do not repot till absolutely necessary. They like to be crowded. The top soil may be dug out of the pot and renewed. It is better than constant repotting.

This story will start off with *Cyrtanthus*. They are as scarce and hard to find in the United States as any of the *Amaryllidaceae* but they are such charming flowers and so adapted to what we would like, that they deserve a nearer acquaintance. They may be our next favorites. Mrs. J. Norman Henry has raised them from seed with great success. In a greenhouse, to be sure, but a cool place, probably, for most South Africans cannot stand intense heat. People fail with freesias, if they do not keep them cool. I would guess the same to be true of *Cyrtanthus*. They have a wide range, along the southeast coast and all the eastern part of the country up to Natal, so some may be more tolerant of heat.

An interesting project was told of in HERBERTIA by R. G. Huey, Superintendent of the Paintsville, Kentucky, Public Schools. There they became interested in Amaryllids and are hard at work hybridizing and cultivating them under supervision. What a fine thing to do!

Ryk Tulbagh was Governor of the Cape from 1751-1771 and during that time he corresponded with the great Linnaeus, who closes a letter, quoted by my friend Frances M. Leighton in Vol. 6, page 16, from Linnaeus to Tulbagh: "May you fully realize" Linnaeus says: "your own fortunate lot, not only in being permitted by the Supreme Disposer of events to inhabit but also to enjoy the sovereign control of that paradise upon earth, the Cape of Good Hope, which the Beneficent Creator has enriched with his choicest wonders. Certainly, if I were at liberty to change my fortune for that of Alexander the Great or of Solomon, Croesus, or Tulbagh, I should without hesitation prefer the latter." A noble wish!

1. CYRTANTHUS

This flower is perhaps unfamiliar to many. It is a group which has great possibilities from the standpoint of pot culture. When we think how short a time it is since freesias of the irids were new and rare and how the hybrids grow better each year; when we see the increasing liking for the "pink red hot poker" of the nearly fool-proof *Veltheimia* of the Lily Family, we can look ahead to see *Cyrtanthus* in all our window gardens.

Dr. Traub, in the preface to 1938 Herbertia, Vol. 5, says: "other plant subjects that are coming into their own are *Cyrtanthus* *Cyrtanthus* appear to be excellent for forcing and some of the species at least are of the earliest culture. As pot plants they are unexcelled."

There is not a wide variety of these bulbs in the United States but seeds may be found and some bulbs. Anyone willing to write to South Africa will find many lovely species. The experimental-minded person has a great opportunity.

Dr. Dyer writes with interest of the *Cyranthus* and its history in botanical literature. The bulbs have been popular in England for a long time, appearing in color over and over in the BOTANICAL MAGAZINE, and others of the old botanical works. The bulbs were extremely popular for a long time, but later did not keep up their promise. This matter may perhaps be explained or suggested, as it affected many of the other South Africans. The old greenhouses in England were heated by old-fashioned kilns. The water supply was not so abundant. The South Africans loved the cool air of these greenhouses which more nearly approached the temperature of their home, especially the cool nights. When more modern greenhouses with warmer air became popular, with watering more copious, they left their abodes and their places were taken by the orchids and other plants liking the warmer temperature. This is a suggested explanation, at least. Now that we have many cool greenhouses and cool, but not too cool sunrooms many of these lost ones may come back.

Dr. Dyer gives a distribution map of this group. They flourish in a band along the south coast of the Cape Province and extend in a wide section up to the east as far as Natal and somewhat beyond, with one species in Rhodesia. They are found generally he says, along the mountain ranges in moist places, in open grassveld and on cool rock ledges. They are not found in the Great Karoo, nor in dry Namaqualand. They keep generally to the places where there is much rainfall. They seem to be among the plants which grow better after the burning of the grassveld, unfortunately so common in South Africa. FIRE LILY is an appropriate name. They like a light soil with good drainage, a soil, Herbert says, that is more disposed to set firm and not fall to pieces when turned out of the pot.

There is nothing else in this country, I believe, to compare with Dr. Dyer's Revision of the Genus (Vol. 6, page 65). He modestly says it is not complete, but it is far beyond anything we have had before, so far as I know. With this, we can in time add to our *Cyranthus* species and hope to identify them. He describes 44 species and there are some excellent sketches.

Miss Stanford, a grower and lover of the South African flora writes in *Herbertia* (Vol. 6, page 214—1939): "Flowers of the *Cyranthus* too are always with us. All winter we have *C. Mackenii* making a sheet of creamy white blossom in a swamp. It grows about a foot high and the flowers have a delicious scent. In early spring *C. O'Brieni* follows with brilliant scarlet blooms and at the same season in sandy soil there is the little *C. angustifolius*. In midsummer *C. obliquus* sends up its big umbels of pendulous blooms from some very dry spot on the top of the rock-garden, that is, if someone has remembered to give it water in summer. Best of all is the rare form of *C. sanguineus* known to us as the INANDA LILY, from the name of one of its haunts in Natal. It likes hard gritty soil and water in Summer." The seasons, of course, are the South African ones.

Cyranthus is a lovely flower. It grows from a bulb, with linear or strap-shaped leaves, flowering in a cluster, rarely only one flower. The flower tube is long and narrow, gradually dilated upwards, two or three times as long as the segments, stamens thread-like, sometimes very short, style long thread-like. *Cyranthus* grows easily from seed. Mrs. Norman Henry has had wonderful success growing them in her greenhouse. It must, I believe, have had a cool temperature. Seeds she planted January 25 were up in five days and the bulbs began to bloom April 2 of the following year, 1941. Other seeds planted March 10, 1940, bloomed May 18, 1941, and ones planted March 12, 1940, bloomed May 15, 1941. Among these were hybrids she had grown and they produced some delightful flowers. She speaks of flowers in coral and sea shell colorings, as well as the whites and reds. She writes: "The flowers of the foregoing hybrid *Cyrtanthus* are all attractive. There is not an 'ugly' in the lot."

The species we are most likely to want to try are the large-flowered ones, *C. obliquus* and *C. sanguineus* and the smaller ones, *C. parviflorus*, *C. collinus*, *C. O'Brieni* and *C. Mackenii* and *C. lutescens*. There are many others.

C. obliquus grows about 1-2 feet tall. The many-flowered drooping umbels are bright red upwards, yellow at the base, and tipped with green, leaves twisted once or twice. They are found on the Cape Peninsula and up to Natal.

C. sanguineus, the FIRE LILY, IFAFA LILY or KEI LILY is bright red with a tube nearly erect or somewhat curved, almost cylinder-shaped in the lower half, one or few to a cluster. From Natal.

C. parviflorus is known as DOBO. Not so tall, flowers red, 1 to 1¼ inches long, 6-12 in a cluster. Wide distribution, as far north as near Barberton in the Transvaal, at over 4000 feet and as far south as Port Elizabeth on the Indian Ocean in the Cape Province.

C. collinus is found on hills in the Cape Province. Flowers bright red, tube curved at base, dilated above. 6-10 in a cluster. Stem about a foot tall.

C. O'Brieni flowers are pale bright scarlet, 7-8 in a cluster, nodding tube, curved perianth, lobes spreading. Natal and eastern part of Cape Province, at about 5000-6000 feet, in crevices of rocks.

The two species, both of which are known as the WHITE IFAFA LILY, are *C. lutescens* and *C. Mackenii*. *C. lutescens* has yellowish flowers, *C. Mackenii* has white flowers, very sweet-scented. *C. lutescens* considered a color variety of *C. Mackenii*. Both have sub-erect flowers, 4-10 flowered in the umbel; the flowers with a tube dilated from the base. High ground in Natal.

Most of these bloom in English gardens from April to June and would bloom indoors from about February.

2. NERINE

There are few more brilliant flowers than the Nerines. The shape, with its six "petals," the color, pink to coral, to salmon, scarlet, orange, red to crimson with the paler tints and white. Some have a mauve tint, some cerise and in some a well-defended bar runs up each segment. The curious quality which these flowers possess of throwing back the light as if from a myriad of mirrors or seeming at night to be strewn with gold dust, combine to make one of the beauties of the flower world.

The GUERNSEY LILY has been a great favorite with English people for a long time, since the Channel Islands learned that these flowers, which they gained by chance, had a steady sale in the English flower markets. The story, probably true, has been told many times of the ship

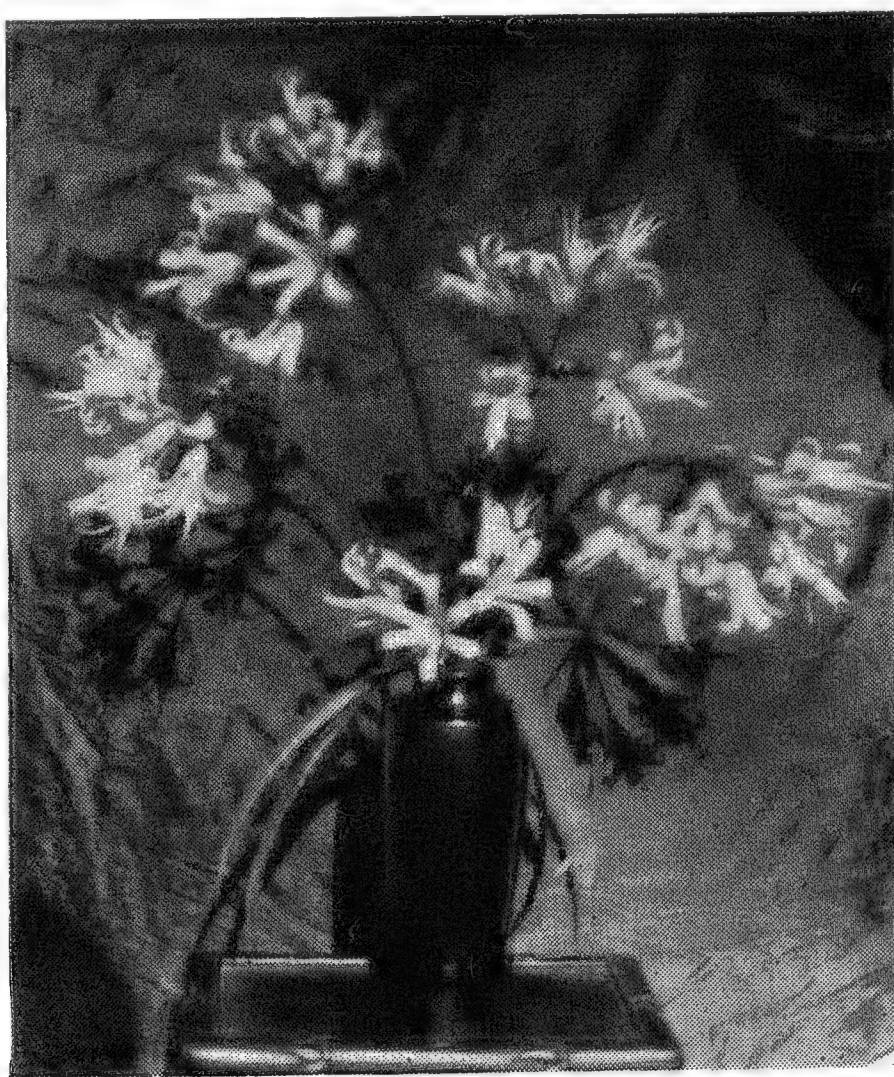


Fig. 202. *Nerine* hybrid—Aurora. Shown at N. Y. Hort. Society Exhibition by Mr. James Stuart. Photo by Sarah V. Coombs.

from Japan which, stopping at Cape Town in South Africa for water brought a quantity of the *Nerine* bulbs. The ship was wrecked on the Island of Guernsey and the bulbs were washed ashore and in time surprised the Channel Islanders with the charming flowers, which they were quick to put to use.

The pronunciation of the name is a bother. It seems to be accepted that this beautiful blossom should carry the hideous appellation of nuh-rye'-nee. Working in the Library of the Royal Horticultural Society at Kew for a time, this writer who often discussed this flower, never heard it called anything but nuh-ree'-nee and in South Africa, its home, it is

always called nuh-ree'-nah. Couldn't we have something better than that ugly nuh-rye'-nee?

Nerines are divided according to different classifications, one, whether the blooming in the umbel is centripetal or centrifugal. They are divided also by the fact that they are deciduous or not. According to L. B. Creasy, long in charge of cultivation at Kirstenbosch, the enchanting Botanic Garden, six miles from Cape Town, all broadleaved ones seem to be quite deciduous, while many narrow-leaved species are more or less evergreen. Nerines grow under a wide range of natural conditions and he is opposed to the wholesale drying off of all species generally practiced under pot-culture. The species should be treated, he says, individually. Any which show a tendency to retain their foliage should not be completely dried off.

This should be considered, since pot-culture practice has normally dried all and sundry. They should all have a rest, a checking of growth, by withholding water but this difference in treatment appeals definitely to this writer's experience.

Many of the Nerines bloom early, in October or November, but some species and hybrids bloom at Christmas time or later. Postponed blooming can be obtained increasingly as house-plants by a longer season. The horticultural variety Aurora (*N. Fothergilli* x *N. Bowdenii*) shown here (Figure 202) is an English hybrid, among many others, Dawn, Empire Day, Comet, Nymph, Hera, etc. The Aurora shown (Figure 202) was exhibited by Mr. James Stuart, Superintendent for Miss Marie Constable's estate at Mamaroneck, N. Y. at a meeting of the New York Horticultural Society one year, about December 20. Mr. Stuart gave the blossoms to this writer, who photographed them. There are some beautiful hybrids to be found in this country and in England. Most of the bulbs available in the United States can be had from September and the flowers come on from October to January. Cold storage holds many freesias back and might hold Nerines, and the time of bloom may be lengthened also by the hybrids.

It is to be hoped that no one ever again will grow the *Lycoris radiata* thinking it is a *Nerine*. It is a lovely flower but *not* a *Nerine*, though it was mistakenly called *Nerine sarniensis* for many years.

Most of the Nerines mentioned below may be obtained in this country and some of the hybrids. Interesting breeding work is also being done.

An early one to bloom is *N. masonorum* L. Bolus, blooming probably too early for use as a house plant. It blooms out of doors in July. In its home abode, it is found "between inundated flat slabs of rock" in the Transkei in the eastern part of the country. The leaves are 4 to 5 linear with a longitudinal groove above. It is a delicate little pink flower, like *N. filifolia* but smaller, with stems glandular-downy. It increases rapidly by offsets and seeds. Grows both in sun and shade.

N. sarniensis Herb. THE GUERNSEY LILY. Leaves about 6, bright green, almost erect, after the flowers, strap-shaped, up to one foot long, obtuse, smooth, $\frac{1}{2}$ - $\frac{3}{4}$ inches broad; stem slender, somewhat flattened, reddish below, 9-18 inches in height; the umbel many-flowered, flowers



Nerine sarniensis var. *corusca* as grown in South Africa. Photo South Africa Railways and Harbours.

bright scarlet, $1\frac{1}{4}$ - $1\frac{1}{2}$ inches long, slightly notched filaments bright red, erect, $\frac{1}{2}$ inch longer than the segments; spathe-valves crimson; fully deciduous. Found on Table Mountain.

This species is not recommended for ordinary planting for, lovely as it is, it does not bloom easily in pots. Its varieties do much better.

Var. *rosea* Herb. Leaves darker green than the type; flowers rose-red.

Var. *corusca* Herb. (Plate 328) Leaves broader than the type, bright-green with distinct cross-bars between the main veins; flowers large, bright orange-scarlet; segments twisted, reflexed; stamens very long; anthers green.

Var. *corusca major*. A fine ornamental plant. Brilliant rose-scarlet. Cool temperature with plenty of air. Blooms before leaves. Flourishes in good loam with a fair admixture of sand.

N. curvifolia Herb. Leaves with a bloom, 6, developed after the flowers, strap-shaped, a foot long, $\frac{1}{2}$ - $\frac{3}{4}$ inches broad, obtuse, curved laterally, thicker in texture than *N. sarniensis*, leaves and flower stalk having a bloom, $1\frac{1}{2}$ foot long; flower cluster 8-12 flowered, flowers erect, bright-scarlet, $1\frac{1}{4}$ - $1\frac{1}{2}$ inch long, segments slightly crisped, sickle-shaped; stamen somewhat erect, about as long as the flowers, scarlet with crystalline-like sheen; style finally about 2 inches long; spathe-valves broadly lanceolate, 1-2 inches in length. Habitat not certainly known. Long in cultivation.

Var. *N. Fothergilli* (Andrews) Baker, more robust in all its parts than the type, leaf broader; flowers more numerous, between crimson and scarlet. A fine cutting flower. Common in English gardens.

Var. *N. Fothergilli major* (Hort) is a form with still larger flowers.

N. flexuosa Herb. Grows in Cape Province at 4000-5000 feet. Leaves 4-6, contemporaneous with the flowers, bright green, linear-strap-shaped, sometimes rough with pustules, one foot long, stem flexuous, slender, with a bloom, up to 36 inches in length; umbel many-flowered, flowers fairly large, declinate, pale pink to carmine, crisped, over an inch long; stamens and style declinate, shorter than the segments, pale pink; anthers oblong, wine-red; spathe valves lanceolate. This bulb likes a damp soil.

Var. *pulchella* Herb. Leaves with a bloom, firmer in texture than the type. Stem not flexuous, flowers pale pink with a rose-red keel; stamens and style almost white.

N. rosea crispa, a hybrid of *flexuosa* and *undulata*. Sometimes considered hybrid of *N. filifolia*. One of the hardiest, can be kept evergreen or dried off.

N. Manselli, hybrid between *N. flexuosa* and *N. Fothergilli*. Does not open its rose-pink flowers until foliage is fully developed. Flowers on slender, graceful stems. One of the latest to bloom, in December or January.

N. bowdeni W. Watson has large rose-pink flowers with recurved and crinkled segments. It is considered almost hardy as far north as New York City. It is closely related to *N. flexuosa* and may be a variety of

that species. It has no truly dormant stage, the leaves remaining green until the flowers are well in bloom. More or less evergreen therefore and thought needing a checking of growth with rest, does not have to have the long baking which some of the species need. Very handsome. It has been called by different names but all describe it as a beautiful flower, larger than any others in cultivation. (This may not be true now with all the new hybrids). It has a stalk 18 inches long, the umbel lax, 8-12 flowered, the flowers $4\frac{1}{2}$ inches across, carried horizontally, large, bright rose-pink, segments spreading, waved, reflexed at the tip, with a deep pink keel, stamens and style declinate, rather longer than the segments; filaments pink; anthers greenish-yellow; spathe valves scarious reflexed at the tip, green ageing to pink; leaves strap-shaped, obtuse, bright green, nearly a foot long; stem longer than the leaves, cylindrical, fairly stout. In Cape Peninsula up to 2000 feet. Long in cultivation. Pink Beauty is a good variety.

var. *magnifica*, pinker and larger than *N. Bowdeni*, 18 to 24 inch stem. Very handsome umbel of 8-12, large funnel-shaped, rose-pink flowers in December.

Fenwick's variety seems much more robust than the species itself, with larger flowers, more blooms to the umbel, is a brighter pink in color and carried on a stem up to 3 feet in height. I have not heard of this variety being obtainable except in England.

N. filifolia Baker, 6-10, leaves thread-like, contemporary with the flowers; not evergreen, 6-8 inches long, erect, flower stalk slender, rounded, bright green, glandular-downy, a foot long; flowers 8-12 in umbel, rather small, carmine, spreading, clawed, crisped at margin, about one inch long; stamens declinate, shorter than the flower-segments; anthers reddish; spathe-valves green. Orange Free State and southwest part of the Cape Province and Swaziland. A very satisfactory plant. Grows well in a sandy loam. Easily increased by seeds and offsets.

N. undulata Herb. Leaves contemporary with the flowers, bright green, linear, 4-6, 12-18 inches long, $\frac{1}{4}$ to $\frac{1}{2}$ inch broad; stem slender, about the same length; flowers much crisped, spreading, pale reddish, 8-12 in umbel; stamens about as long as flower segments and declinate; anthers plum colored; spathe valves narrowly lanceolate. Coast Region, Cape Province and western Orange Free State.

N. humilis Herb. Scape often smaller than other kinds, about one foot in length, nearly round, with a slight bloom, leaves about half-grown when the flowers bloom, linear, strap-shaped, bright green, nearly erect, channelled down the face; flowers 10 to 20 in umbel, spreading, purplish-rose color, variegated with paler tints, narrow, somewhat crisped and notched, segments all point upward; stamens and style declinate, rose-red, about as long as the segments; anthers yellow at first, then purple; spathe-valves lanceolate, greenish-pink. In Cape Peninsula up to 2000 ft. Long in cultivation. A brilliant plant.

N. appendiculata Baker. From Natal and the mountains of the Eastern Districts. It grows in moist positions by streams in full sun. Flourishes sometimes in a swamp. Red segments one inch long, linear,

toothed, crisped in upper half, distinctly keeled; filaments and style rather shorter; spathe-valves small, membranous, red-flushed, flowers 10-15 in umbel; leaves 3, contemporary with flowers, linear, a foot long, deeply channelled down the face; stem stout, rounded, about 2 feet long. Filaments are furnished with a strap-shaped, irregularly cleft appendage at the base.

N. lucida Herb, wide range but found mostly in sections with scant rainfall. Leaves 6-8, bright green, narrow, contemporary with flowers, flabby, one foot or more long; stalk short, stout, flattened; flowers 20-40 in umbel, pink, pale or bright red up to two inches long, line in middle of petals, in and out side, very little crisped, clawed, stamens and style declinate, nearly as long as the flower segments; spathe-valves ovate-lanceolate, short. Seeds mature very quickly and germinate promptly, not so bright or showy as some others but attractive.

Many fine hybrids are being produced both in England and this country and there is great hope for a future with these beautiful bulbs. When their needs are understood and good plans for their cultivation followed, they will become familiar.

The following cultural details are based in part on suggestions obtained from an article by Francis Hanger, Curator at Wisley.

A very important point with the cultivation of nerines is to give them great care after blooming, to build them up for the next year. Before they are ready for their rest, while the leaves are growing, frequent doses of weak liquid manure should be given.

In planting nerines, they should have a soil consisting of 2 parts sandy loam, 1 part well-decayed manure, 1 part leaf mold and 1 part coarse sand. The soil should be mildly acid to neutral, 6.5-7 pH. Sandy soils are likely to be more acid and drainage is better. Mr. Houdyshel considers an alkaline soil most frequent cause of failure. Full sun.

Bulbs, when planted should be covered only three-fifth or even one-half. 5 bulbs to a 6 inch pot, or 3 or 4 big ones to the same size. They like to be crowded, as many South African bulbs do. *N. filifolia*, with its small bulbs, may be planted 12 bulbs to a 6 inch pot.

After blooming, keep up cultivation as above until leaves begin to turn yellow or to show signs of needing rest. The kinds with evergreen foliage do not need as long a rest as the others, which must have several months of baking, with no water or only an occasional dose. Pots may be laid on their sides when tops have dried off or covered with a little salt hay. If a bulb must be transferred to a larger pot, or "potted on," this should be done immediately after flowering as the roots are active and will fill the new soil quickly, so that there is no chance for the soil to become stagnant, a cause of frequent trouble.

Nerines should not be shaken out and repotted completely because of the crowding till they are in danger of bursting the pot, and this change

[SOUTH AFRICAN AMARYLLIDS—COOMBS, continued on
page 163.]

DISEASES OF AMARYLLIDACEAE, EXCLUDING THOSE OF ALLIUM AND NARCISSUS

PHILIP BRIERLEY¹

Following the usage of this journal, Hutchinson's (5) and Traub's (16, 17) delimitation of the *Amaryllidaceae* is followed, with the omission of the diseases of *Allium* and *Narcissus* which were treated in *HERBERTIA* for 1944 and 1946, respectively. Published information on diseases of other amaryllidaceous genera is widely scattered and not extensive. Bulletins on diseases of ornamental plants rarely treat any of our present subjects, and the available texts in this field deal with *Amaryllis* Linn. (syn. *Hippeastrum* Herb.), *Galanthus*, and sometimes *Hemerocallis*; German texts discuss *Clivia* also, and one American text includes *Crinum*. Moore (9) in an English review entitled DISEASES OF BULBS includes exhaustive surveys of diseases of *Narcissus* and *Galanthus*.

Two diseases, red leaf spot caused by the fungus *Stagonospora curtisii* and mosaic caused by one or more viruses, are reported as affecting many amaryllids. These will be discussed first, and those diseases more restricted in known activity will be treated under the individual genera. It is of interest to note that *Amaryllis* Linn. and *Narcissus* appear to be immune to rootknot nematode (*Heterodera Marioni*), and that *Agapanthus* and *Hemerocallis*, though susceptible, are not commonly attacked (18). Furthermore, the reports (14) that *Amaryllis* Linn., *Crinum*, *Narcissus*, and bulb and corm plants in general, appear to be immune to the cotton root rot fungus, should be good news to growers in areas of the Southwest where this disease occurs.

Red Leaf Spot

Red leaf spot, a fungus disease caused by *Stagonospora curtisii*, is reported as affecting *Amaryllis hybrida*, *A. vittata*, *Brunsvigia rosea* (Lamarck) Hann. (syn. *Amaryllis belladonna* Ait., non Linn.), *Chlidanthus fragrans*, *Crinum asiaticum*, *C. bulbispermum* (Bur.) M. & S. (syn. *C. longifolium* Thunb.), *C. Powellii*, *Eucharis grandiflora*, *Galanthus byzantinus*, *Galanthus* sp., *Hymenocallis calathina*, *Leucojum vernalis*, *Lycoris squamigera*, *Narcissus* spp., *Nerine* sp., *Pancratium maritimum*, *Sprekelia formosissima*, *Sternbergia lutea*, *Vallota* sp., *Zephyranthes candida*, and *Z. rosea*. The disease is unknown in *Hemerocallis*, and attempts to infect *H. aurantiaca* (11) and *H. fulva* (7) were unsuccessful. Attempts to infect *Agapanthus umbellatus* and *Allium neopolitanum* also failed (11). The same disease is known as red blotch and red fire in amaryllis, and also as leaf scorch in narcissus. It is prevalent in both Europe and America, and has been reported in Argentina (9). Creager (2) made a detailed study of the fungus and the course of its development in nar-

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cissus. Smith (11) showed that the same fungus can attack many amaryllids; Laskaris and Dodge (7) gave an account of the disease in *Amaryllis* Linn.; and Weiss (19) summarized information on red leaf spot and offered suggestions for control.

In *Amaryllis* hybrids red leaf spot appears first as small round red spots on leaves, flower stalks, or petals. Insect or mechanical injuries also produce reddish spots that may be confused with the early stages of the fungus disease. Later the fungus spots enlarge and coalesce, forming elongated cankers with red borders and brown or gray centers. The fruiting stage of the fungus, small dark specks slightly protruding from the tissues, may appear near the centers of large lesions. Spots are most damaging on the flower stalks, where they often cause one-sided growth. The bulb scales about the neck of the bulb are often attacked, but *Stagonospora* is not known to cause decay of the bulb, except in *Galanthus byzantinus*, according to English workers. In *Zephyranthes candida* leaf spots remain small but are surrounded by a bright yellow zone. In narcissus, the lesions are brownish rather than red.

Creager (2) furnished good evidence that *Stagonospora* is carried on the bulb of narcissus, and it is generally assumed to be bulb-born in other amaryllids also. It appears to persist in the papery scales about the neck of the bulb where it is often found fruiting. The new leaves and flower stalks become infected as they crowd through this neck area. The primary infections thus established give rise to new crops of spores that can initiate a new series of leaf spots if humid conditions prevail.

Control measures include removal of diseased material, and at least one annual cleaning of the bulbs. A formaldehyde soak (1 part commercial formaldehyde solution to 200 parts water for 2 hours) for dormant bulbs has proved effective in eliminating the bulb-borne phase of the disease from narcissus (2) and is safe for *Amaryllis* Linn. (19). Field plantings of *Crinum* and of narcissus, especially Paperwhite and Soleil d'Or, are commonly sources of the red leaf spot fungus and therefore undesirable neighbors for other susceptible amaryllids. Spraying with Bordeaux mixture plus a sticker is often recommended, but the value of this measure has not been demonstrated. In greenhouse culture, much can be accomplished by keeping the foliage dry and by proper spacing.

Mosaic and Other Virus Diseases

Virus diseases of the mosaic type have been noted in many amaryllids; but if we exclude *Narcissus* and *Allium*, we find that very little is known about these diseases. Mosaic diseases of *Amaryllis* hybrids, *Amaryllis xJohnsonii* (syn.—*Hippeastrum xJohnsonii*), *Amaryllis belladonna* Linn. (syn. *Hippeastrum equestre* Herb.), *Eucharis grandiflora* (syn. *E. amazonica*), and *Nerine sarniensis* have been known for 20 years or more, and in more recent years Hannibal (3) has observed mosaic symptoms in species and hybrids of *Amaryllis*, *Crinum*, *Cyrtanthus*, *Eucharis*, *Hymenocallis*, *Phaedranassa*, and *Urceolina* in California. Cooley (1) has reported a disease, possibly of virus origin, in *Hemerocallis* in Maryland and a virus disease of daylily in California is also on record (20). Such

diseases of one or more amaryllids are known in Europe, Hawaii, Bermuda, Puerto Rico, and Japan, as well as in the continental United States.

Mosaic diseases are recognizable by irregularly distributed light and darker green areas in the leaves. In *Amaryllis* hybrids the pattern is a coarse one, with large patches of yellowish-green appearing at random over the leaf surface. The yellowish areas have irregular margins, and shade into the normal green areas without a well-defined line of demarcation. There is little distortion of the leaf in *Amaryllis*, and affected plants are not conspicuously reduced in vigor. In *Eucharis grandiflora*, which is commonly affected, there is some waving of the leaf margins as well as light and dark green mottling. Symptoms in the other plants reported subject to mosaic are not described in detail. It is to be expected that some of them may show much less prominent and finer grained mottling.

The agents of transmission of the virus diseases of narcissus and those affecting onions are now well known. The mosaic and the white streak diseases of narcissus and the onion yellow dwarf disease are carried by certain aphids (plant lice) and are also experimentally transmissible by simple mechanical methods. In contrast, none of the mosaic diseases of other amaryllids listed above has been shown to be transmissible by natural agents or by experimental techniques. In fact, the evidence that these are virus diseases consists chiefly in the virus-like patterns expressed, in the persistence of these patterns in vegetative divisions of affected plants, and in the occurrence of characteristic foreign bodies within some of the cells of leaves that show mosaic mottling. These "inclusion bodies," or "X-bodies," or "viroplasts," are associated with virus diseases of the mosaic type in many plants, such as sugarcane, wheat, tobacco, and *Dahlia* as well as in *Amaryllis* Linn., and *Eucharis*. These inclusions were studied intensively (4, 6, 8) some 20 to 25 years ago when they were considered possible casual agents of the virus diseases they accompany. They are not organisms, as once thought; but they do contain a high concentration of the virus agent, and their presence is so closely correlated with mosaic infection in some plants that they are useful in diagnosis.

There is little evidence that the mosaic disease or diseases affecting the amaryllids here treated are disseminated by natural agents, such as insects. However, natural spread of *Amaryllis* mosaic is reported by Holmes (4) in New York and is at least implied in reports from Bermuda (10) and from Florida (15). All tests for seed carriage have been negative, and it is assumed that the virus is not seed borne. In the absence of seed carriage and of insect spread in greenhouse cultures, the simple procedure of discarding affected plants and propagating from unaffected individuals should effect control. In Florida (15), even though natural spread is implied, roguing diseased plants from the field is reported effective.

In addition to the true mosaic diseases, another virus disease known as tomato spotted wilt is reported as affecting *Amaryllis* Linn. in Eng-

land. Leaves of affected plants show numerous yellow or white spots which may be isolated or may have coalesced into pale patches. The leaves finally turn yellow and die (12). The symptoms are similar to those of *Amaryllis* mosaic but much more severe. Tomato spotted wilt is disseminated by thrips, and is capable of affecting a great many plants, notably tomato, *Tropaeolum*, *Begonia*, and *Zantedeschia*, as well as *Amaryllis* Linn. To avoid this disease in *Amaryllis* Linn., avoid such sources of the disease as those noted above, and control thrips.

Diseases Reported Affecting Individual Genera

Agapanthus.—*Agapanthus* is reported subject to a seedling and leaf blight caused by the fungus *Phytophthora parasitica* in Japan. This soil-borne fungus is world-wide in distribution and affects a very wide range of plants including *Agave* and *Lilium*, but is not reported to attack other amaryllids. Two leaf spots, caused by *Ascochyta hyacinthi* and *Mycosphaerella agapanthi*, are reported as affecting this plant in Italy and Australia and in South Africa, respectively (13).

Amaryllis Linn. (syn. *Hippeastrum* Herb.).—In addition to red leaf spot and mosaic discussed above, the Plant Disease Survey (20) has records of a number of other fungus diseases of *Amaryllis* Linn., species and *Amaryllis* hybrids in the United States. A soft rot of the bulbs is caused by *Rhizopus stolonifera*, and in Florida *Sclerotium rolfsii* also produces bulb decay. *Botrytis cinerea* induces gray mold blight and bulb rot occasionally, chiefly in outdoor plantings after chilling. A root rot of seedlings in Florida and Texas is reported as being due to *Pythium debaryanum*. Black mildew (*Asterinella hippeastri*) occurs on *Amaryllis belladonna* Linn. in Puerto Rico. A leaf spot caused by *Cercospora amaryllidi* appears on *Amaryllis* hybrids in Alabama, Louisiana, and Puerto Rico as well as in Europe. In other countries rusts, *Aecidium amaryllidis* in India and *A. hippeastri* in Chile, are recorded, and an anthracnose, *Septogloeum amarylli*, was found attacking amaryllis under glass in Russia. *Puccinia habranthi* is found on *Amaryllis andicola* (syn. *Habranthus andicola*) and *P. reichii* on *Amaryllis chilensis* (syn. *Habranthus chilensis*) in Chile (13).

Brunsvigia.—This genus is subject to many of the diseases affecting *Amaryllis* Linn. Specific diseases recorded (13) are a rust, *Aecidium brunsvigiae*, on "*Brunsvigia* sp." in South Africa, and a smut, *Tilletia sydowi*, on "*B. (Ammochloa) subacaulis*" (sic) in Algeria.

Clivia.—No American record of disease in *Clivia* has been found, but these plants are attacked by three leaf spot fungi in Europe, *Ascochyta cliviae* in Italy, *Colletotrichum cliviae* in Bohemia, Holland, and France, and *Physalospora himantophylli* in Spain (13). In addition to these parasitic diseases, two disorders of non-parasitic origin are described from Denmark as "marginal spot" and "cork disease." The former is first characterized by tiny yellowish spots along the leaf margins, and later by bleaching, browning, and shriveling of patches of leaf tissue. The cork disease is marked by the development of many small slightly raised areas in the leaves.

Cooperia.—This is subject to rust, *Puccinia cooperiae*, in Texas (20).

Crinum.—*Crinum* diseases in the United States include, in addition to red leaf spot and mosaic, another leaf spot caused by *Cercospora pan-cratii* in Alabama, Florida, Mississippi, and Puerto Rico (20). Elsewhere two rusts, *Aecidium crini* and *A. mangaranga*, occur in South Africa, and three more leaf spots are known, *Gloeosporium crini* and *Septoria crini* in Italy, and *Mycosphaerella crini* in the Caucasus.

Eucharis.—*Eucharis* is affected with gray mold blight, *Botrytis cinerea*, in Florida (20), and by two rusts, *Aecidium deliculatum* in Trinidad and *Uredo eucharidis* in Ecuador and Peru (13).

Galanthus.—*Botrytis* blight, caused by *Botrytis galanthina*, is an important disease of snowdrop in Austria, England, Denmark, Holland, Germany, and Sweden (9), but has been noted in the United States only in the sclerotial stage on imported bulbs (20). Plants are often attacked as they emerge from the soil in spring. At this time some are seen to be covered with a felt of gray mold, and the whole plant including the bulb is soon completely rotted. The sclerotia, a resting stage of the fungus, are round or irregular in shape, black, and about the size of a pinhead. These sclerotia often develop on the papery outer scales of the bulbs, and are thus carried in commerce. When slightly affected bulbs are planted they often fail to emerge, and rot completely. The fungus seems to attack snowdrops through the soil rather than by air-borne spores, and persists for at least a year, and perhaps much longer, in soil that has borne a diseased planting. *Botrytis galanthina* is considered distinct from the *Botrytis* spp. attacking other flower bulbs, and does not attack other plants as far as known, but the allied *B. narcissicola* from narcissus has been induced to attack *Galanthus* experimentally. *Galanthus nivalis*, *G. graecus*, *G. Elwesii*, and *G. Fosteri* are susceptible to *Botrytis* blight, while *G. nivalis-charlochii*, *G. nivalis-redoutei*, *G. cilicicus*, and *G. plicatus* show evidence of resistance (9). For control, avoid planting diseased bulbs, and avoid soil known to harbor the disease. Bulbs with sclerotia in the outer papery scales only may be cleaned by removing these scales. If *Botrytis* blight is recognized in a planting of snowdrops the affected plants should be removed with some of the surrounding soil and burned (9).

A *Sclerotium* sp. occurs on the outer papery scales of snowdrop bulbs in Europe, resembling the sclerotial stage of *Botrytis* except that the black bodies are much smaller (9, 20).

A smut, *Urocystis Galanthi*, is recorded on Snowdrop in Germany, and two rusts, *Melampsora galanthi-fragilis* and *Puccinia galanthi* are known in Europe.

Haemanthus.—This is subject to a leaf spot caused by *Cercospora haemanthi* in South Africa (13).

Hemerocallis.—In addition to root-knot and the possible virus disease mentioned above, there are records (20) of fungus leafspots on daylilies caused by *Botrytis* sp. in Maryland, by *Cercospora hemerocallidis* in Illinois, and by *Heterosporium gracile* in New Jersey. A root rot caused by *Sclerotium* sp. is reported from Indiana. The *Cercospora* leafspot is

also recorded in Bermuda. Elsewhere (13) a rust, *Puccinia hemerocallidis*, is known in Siberia and Japan, a leaf spot due to *Colletotrichum liliacearum* in Italy, and one due to *Mycosphaerella hemerocallidis* in Yugoslavia.

Hymenocallis.—This may be attacked by *Cercospora pancratii*, causing a leaf spot in Florida, Louisiana, Texas, and Puerto Rico, and in Puerto Rico by *Mycosphaerella aggregata*. Large dark brown leaf spots in Java are caused by *Tubercinia javanica* (13).

Ixiolirion.—This is subject to two rust diseases due to *Aecidium ixiolirii* and *A. tartaricum* in Asia (13).

Leucojum.—A *Botrytis* is recorded on bulb scales in Oregon. A rust, *Puccinia schmidtiana*, is found on snowflake in Austria, Germany, and Italy; also leaf spots due to *Ramularia ucrainica* and to *Septoria malisorica* in Southern Europe (13).

Lycoris.—This has been reported to be attacked by the bulb nematode *Ditylenchus dipsaci*, and by two other species of nematodes, *Aphelenchoides fragariae* and *Hoplolaimus* sp., in North Carolina and Virginia (20).

Pancratium.—A rust, *Aecidium amaryllidis*, is reported from India (13).

Zephyranthes.—A rust, *Puccinia cooperiae*, is found in Alabama, Florida, and North Carolina; a leaf spot due to *Colletotrichum liliacearum* in North Carolina; and a scale speck due to *Sclerotium* sp. in Oregon (20). Elsewhere the rust *Aecidium zephyranthis* is found in Mexico, and a leaf spot due to *Septoria psittacina* in Italy (13).

Only fragmentary information is available on the diseases mentioned, with the exception of the red leaf spot and mosaic diseases and the *Botrytis* blight of *Galanthus*. Indeed, all we know of many of these troubles is that they were found on a certain plant in a certain place at a certain time. This furnishes very little basis for evaluating their importance. We might assume that a disease recorded only once in a distant land is of no concern to domestic cultures, but such an assumption is not necessarily sound. Studies on the nature of these diseases and on the conditions favoring their development would be reassuring, for to be forewarned is to be forearmed.

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SURVIVAL OF AMARYLLIDS, 1941—1945

RUSSELL S. WOLFE, *South Carolina*

[Russell S. Wolfe served as an officer in the U. S. Armed Forces during World War II, and we are pleased to have him back again in the ranks of amaryllid enthusiasts.—Ed.]

In response to Doctor Traub's request to write a few notes about results noted in my bulbs due to their neglect during the years 1941-45, it seems necessary or proper to make a few explanatory remarks.

Although my absence from home began about mid-February 1941, the effect of the loss of help (labor) and my presence or advice was not so noticeable during that season.

Beginning 1942, my assignment caused me to be too far away to be able to keep in touch with affairs at home. My labor gradually began getting away, going into the service or into some war-work until there were finally less than ten per cent of my usual crews remaining. There was no one with the "know-how" or managerial ability to carry on. Finally, my letter to the colored foreman instructed him to just take care of whatever fields he could with the available labor. The situation upon my return is briefly expressed in the following notes.

Allium spaerocephalon—bulbs had multiplied and were very small; and, the resulting bloom heads were also small.

Amaryllis—in the fields were generally in fair condition. It had become my custom to group all *Amaryllis* bulbs resulting from any certain cross in the same bed or row. Therefore it was readily noticed that some groups were evidently hardier than others. For instance, some groups had many vacant spaces in the bed where the bulbs had died; while other groups had multiplied into large clumps that had become almost too crowded for proper blooming. Some of the bulbs had grown too high out of the ground, causing them to be susceptible to freezing.

Chlidanthus fragrans—had developed into large tight clumps of very small bulbs, too small to bloom.

Cooperia pedunculata—were barely existing.

Gladiolus—about five acres of these bulbs were a complete loss.

Gloriosa virescens—came up and bloomed serenely in spite of all the grass and weeds.

Amaryllis advena—multiplied into large clumps right along with the thick Bermuda grass; but, *Habranthus brachyandrus* were hard to find.

Habranthus brachyandrus—were hard to find.

Hedychium coronarium—had deteriorated; but, were still living and blooming.

Hemerocallis (in about thirty varieties and many seedlings)—suffered very little if any ill effects, and, had developed into large strong clumps.

Hyacinth, Roman (blue)—had developed into large clumps of small bulbs that bloomed sparsely.

Iris siberica—in high spots in the open fields the plants had disappeared; but, in the lower places, had multiplied into thick clumps of many divisions that bloomed nicely.

Lilium Henryi—were rather deteriorated and many bulbs missing; *Lilium* (Regal)—had practically disappeared; *Lilium tigrinum*—were in fair condition.

Lycoris aurea—were living, but in a rather deteriorated condition; *Lycoris radiata*, *L. radiata alba* and *L. squamigera* seemed normal, in fact, had developed into large clumps that bloomed profusely.

Milla biflora (Estrellita)—only a few small bulbs survived, striving gamely to bloom, a few succeeding.

Narcissus—in different types showed varied results. The large trumpet types suffered more. Other types, such as the Soleil d'Or, Laurens Koster, Orange Cup, Sir Watkins, and Queen Anne multiplied and grew into large clumps of small bulbs, while the Paperwhites (about four acres) were practically lost. Field mice in burrows are given credit for eating many of the *Narcissus* bulbs in the grassy field.

Scilla hispanica—had disappeared, except in shady spots where large clumps of these bulbs bloomed profusely. It is thought that field mice ate many of these bulbs.

Sternbergia lutea—were alive, but rather deteriorated. Only a few blooms with short stems.

Triteleia (*Milla uniflora violacea*)—seemed to suffer no ill effects, developed into thick clumps that bloomed nicely.

Zephyranthes (white), *Z. atamsco*, and *Z. Ajax*—had developed into nice clumps of small bulbs that bloomed normally; *Zephyranthes carinata*—had only a few bulbs remaining; *Zephyranthes citrina*—were in fair condition; *Zephyranthes lutea*—were almost extinct, except in fairly shady spots; *Zephyranthes rosea*—had completely disappeared.

Upon my return, it was soon learned that very little labor was available. After making a survey of the plantings, it was decided to heavily fertilize and properly water all bulbs, whether or not possible to clear grass and weeds in advance. And later, to offset lack of sufficient labor, labor saving machines and tools were substituted until all planting could be cleaned up. Then, during the proper seasons, overcrowded bulbs were dug, divided and replanted into fresh fields.

It seemed that the above briefly outlined plan (especially the heavy fertilization, whether or not previously cleaned of grass and weeds) was wise, as all the above mentioned bulbs quickly responded favorably, and, at present seem to be in good normal condition.

These brief notes would indicate that many bulbs stand more neglect than others, and, are tougher than most any other types of plants; because, practically all of my plantings of Hardy Asters, Shasta Daisies, Hartje and Elder Daisies, Roses, Aquilegia, Phlox and other perennials were a complete loss.

BLOOMING HABIT OF *LYCORIS RADIATA*

W. R. BALLARD, *Maryland*

Some years ago someone gave me a few bulbs of what were known in the southland as "Coral lilies." They looked much like *Narcissus* bulbs and so were planted as recommended for this common bulb. I was interested to discover that the foliage started to grow in the fall and lived over winter, finally dying down about the last of June. Later in the summer I was surprised to find naked flower spikes pushing up rapidly. After they came into bloom, I wanted to know what they were. It did not take long to determine that they were the amaryllid now known as *Lycoris radiata*.

I had planted them in a sandy loam soil of only moderate fertility and they have continued to flourish for several years blooming every year in August or early September, their appearance varying somewhat with favorable moisture conditions.

Four or five years ago I decided to give some of the bulbs better growing conditions. I therefore prepared a special bed for them, incorporating with the soil a generous supply of leaf mould. Under these conditions the bulbs have grown satisfactorily but to this day they have never produced a single bloom. A garden friend of mine has had a similar experience and he has threatened to dig all his bulbs up and throw them away.

Meanwhile the original bulbs left undisturbed continued to bloom as regularly as the season come around. These are growing in ordinary sandy loam in full sun. The moral seems to be: "*Dont treat these bulbs too kindly!*"

LEUCOJUM AUTUMNALE AS A POT PLANT

HAMILTON P. TRAUB

In a recent issue of HERBERTIA [14(1947): 100. 1948] reference was made to the excellent qualities of *Leucojum autumnale* as a pot plant. It was stated that although this species normally blooms only in the fall or early winter in its native habitat, it proved to be practically ever-blooming when grown as a pot plant indoors. It has since been determined that it is everblooming only if the temperature is kept at 75° to 85° F., or somewhat above. If the temperature is kept at 65° to 75° F., or below, the plant remains in the vegetative condition until the advent of the relatively warmer spring weather, after the fall—early winter blooming period. Most amaryllids have distinct blooming periods even under pot culture, and this is an unusual case among this plant family. The illustration (Figure 203) shows an 8-inch pot-ful of *Leucojum autumnale*, which increased to the present number from 8 small bulbs within two years. The photo was taken on May after the bulbs had flowered profusely for months. The bulbs are now so crowded that repotting is necessary, beginning again with 8 bulbs to each pot.

In central and southern California, and possibly farther north, *L. autumnale* should prove to be an excellent rock garden plant. It might also be adapted to Arizona, New Mexico, South and Central Texas, and should be tried out in these states. Apparently it has not been tried out in the southeastern states. Reports from others who have grown this plant would be of interest.



Fig. 203. *Leucojum autumnale* as a practically everblooming pot plant.

AMARYLLIS AMONG THE CLIFF DWELLERS

LEONARD C. SMITH, *Illinois*

Many modern cliff dwellers—those curious beings who, for reasons I can never hope to understand, seem to prefer vertical living—live and die without realizing that the *Amaryllis* offers an excellent opportunity to satisfy that innate longing which every normal person has for something “green and growing.” Ivy, *Philodendron*, and *Nephtytis* are quite all right for greenery, but once the city apartment dweller has experienced the drama of a hybrid *Amaryllis* bursting forth into glorious bloom right on his own window sill, he is prone to look with disdain on

any plant less spectacular. The play upon his vanity must not be overlooked; he is the envy of the entire neighborhood. After all, he shares the front entrance to his edifice with from six to sixty other refugees from nature. How can they avoid seeing it when it has been placed so conspicuously? And, if they take no notice, the proud possessors will carry it over to their apartment to gloat.

Now, the only thing wrong in this picture is that more people are not doing it, especially in the crowded sections of large cities. And it is not alone the blooming of *Amaryllis* that is possible on an apartment window sill. Here, in our Chicago cubicle, we bloom them, cross-pollinate them, ripen the seeds, plant the seeds, rear the seedlings, and bring them into bloom, completing the entire life cycle, in the sunshine of a double window in a bedroom.

Almost anyone can secure blooming-size *Amaryllis* bulbs from his seedsman. But even the garden club members seem to believe that the production of viable seeds and the raising of the seedlings require some sort of black art or abracadabra. Attention to a few simple details will disclose that it not only can be done but that a whole new sphere of interest will be revealed.

We try to bring into bloom simultaneously those specimens which would seem to possess good attributes for parenthood of seedlings. Cross-pollination is accompanied by transferring the pollen to the stigma of the seed-bearing parent. Such crosses are usually made on a reciprocal basis. In that manner, both bulbs will probably set seed. After ripening, the seed is planted in moist sphagnum. A small aquarium with a pane of glass covering the top provides the "Wardian case" conditions of humidity and temperature in which the seedlings seem to thrive. They remain in the aquarium, with just an occasional sprinkle of water, until they are ready to be potted in two-inch pots or several in a larger pot. Weak manure water introduced into the sphagnum will stimulate growth before potting.

Most of our seedlings we take with us on an annual trek to our little home in Winter Park, Florida. There they grow into maturity in the garden, but we have carried them through to maturity right on the window sill in Chicago. Some of these days we hope to be emancipated from "cliff dwelling" and be privileged to broaden our fields of operation—and our fields of *Amaryllis*. We are confident, however, that we would not depart widely, except in scale, from the routine that has been established in the production of seedlings.

We would not be so brash as to indicate that what we need in this country to cure our ills is for the President to declare an "*Amaryllis* Week," or for a great campaign to be launched on the theme: "Have you a little *Amaryllis* in your apartment?" But we are convinced that a world of pleasure awaits many thousands of urban dwellers who learn that, through the *Amaryllis*, their six-inch by twenty-six-inch window sill can become a bedroom botanical garden.

NOTES ON HYBRID *AMARYLLIS*

J. G. DUPUIS, M.D., *Miami, Florida*

During and since the recent blooming season of the year 1948 (February to May) daily visits have been made through my *Amaryllis* garden and many gorgeous and beautiful patterns in a panorama of colorful blooms have been observed and enjoyed, together with several new individual color patterns which have been marked for future reference and study. One of them is entirely red including the throat of the bloom. Also I have marked one bloom which is entirely red, producing eleven tepalsegs, and another of the same color with sixteen tepalsegs. These individuals have never been observed prior to this year.

Last year, 1947, we had marked three perfectly white *Amaryllis* that were taken up and potted; one has reproduced a beautiful bloom, the other two have not bloomed up to this time and are probably taking a rest period. Besides these individuals which have been marked for identification there have been observed several patterns intermediate between many colors and patterns of colors heretofore unobserved—these have been so marked to study their future behavior.

In my collection, I have an individual “peach orchid” bloom which is identified as No. 11 and is both entertaining and distinctly beautiful. This bulb is smaller than the average bulbs in my collection and is a rare individual which has no tendency to develop and reproduce offsets nor do the seed pods have a tendency to develop or mature seeds. As there are only a small number of these individual bulbs in my collection I resorted to the splitting of 28 bulbs to produce more bulbs of this variety. All of these bulbs produced an average of two bulbs each, however, all the mother bulbs dried up and perished, and the new bulbs that were produced were very small in size and will take from two to three years before they will be large enough to bloom.

With such poor average results by this surgical procedure on this particular individual variety of bulb, I feel that this method has been a failure, as I had 28 blooming size bulbs to start with before this experiment and they usually produced one offset each during the year, therefore, you can readily calculate that this program of reproduction is not encouraging on this particular type of hybrid *Amaryllis*. Perhaps, under other conditions better results might have been obtained.

This past season on my No. 15 bulb, a very robust clone producing a large flower, I tried the experiment of covering the bloom just before it opened, both with wax paper and also cheese cloth on different blooms and letting it remain covered until the bloom had thoroughly wilted and the seed pods formed. In planting of the mature seed, a germination of 25 to 30 percent was the result. Open field and uncovered blooms germinated 75 to 90 percent.

Throughout the past blooming season of 1948 (February to May) it is gratifying to report that the flower markets in this area and their patrons are becoming more conscious of the beauty and value of the

hybrid *Amaryllis* as a cut flower, not only for their colorful blooms but for their lasting qualities, and we sell many thousands of blooms locally to florists and flower markets during the blooming season and at Easter. Due to the many thousands of bulbs in my garden and their varying ages, we are able to supply a few blooms during each month of the year—and in my opinion it is only a matter of a short time before the hybrid *Amaryllis* will be recognized as a cut flower as well as a potted flower.

THE DAYLILY IN THE GARDEN

W. R. BALLARD, *Maryland*

It would appear that many of the modern varieties of daylilies have been introduced on the basis of size, shape or color of bloom or because of a favorable season of flowering. Apparently little consideration has been given to the effect which a well developed clump might have in the hardy border.

One reason for this is undoubtedly the desire to propagate the new variety quickly in order to get it into the trade. It takes a little time to develop a well grown clump that would approximate the performance which could be expected of the variety when placed in the flower garden, and many producers are not willing to make careful tests along this line.

It is true that garden effect sometimes depends upon other factors than the qualities inherent in the variety itself. One need mention only the question of a suitable background and contrasting forms of other plants.

However, there are a number of features of a daylily which give it value as a member of the garden family. Good foliage is one of these. Obviously the evergreen type is the one to be preferred. The foliage should present a pleasing appearance not only up to the time of blooming but also after the flowering period is over.

A variety should have good proportion—the relation of the mass of bloom to the mass of foliage, the size of the flower to the stem. If the flower is large, the stem should be sturdy enough to support it properly. In some cases the length of the stem will be entirely out of proportion to the size of the flower.

It is desirable that the plant should have a large number of flowers open at one time to give a mass effect. There should be a comparatively long season of bloom. Stems need to be well branched to display the flowers to advantage. The multiflora types have this characteristic well developed. Sometimes a mass of small flowers are more attractive in the garden than a few large flowers.

Dwarf forms for the front of the border, tall types for the rear and others of medium height all have their place in the hardy border.

The daylily, like many other fine perennials, responds to good culture. When given special treatment, varieties sometimes give such a good account of themselves that visitors often fail to recognize even the common varieties. Varieties are frequently more floriferous under these conditions.

Season of bloom is an important consideration in the selection of varieties for the garden. Care should be given to the placement of day-lilies so that those in bloom at any one time are well distributed throughout the border.

Modern varieties which maintain a nice clump are much preferable to some of the older types which spread widely in the garden and interfere with the growth of other plants and at the same time break up the garden picture as designed.

So many suitable varieties are now available for garden use that there is little excuse for not making important use of this flower when any one contemplates establishing a hardy perennial border. It would be very helpful to beginners if a list of the most adaptable varieties for garden use could be published in a future report. A systematic drive should be made to induce a wider use of this most satisfactory plant in developing perennial gardens.

NOTES ON DAYLILIES IN 1947

J. S. COOLEY, *Maryland*

The march of the seasons has its interesting as well as its discouraging aspects for the daylily enthusiast. In 1947 the early varieties were very disappointing. They gave very few blossoms and some of those were misshapen. The cold weather in April and May, after the shoot growth had started, probably affected the quantity and quality of the flowers. The temperature was as low as 26° F in May. The bloom scapes of the early variety Elizabeth were frozen to death. Apparently the crowns of some of the early mid-season and mid-season varieties were so injured that blooms were scarce. Such varieties as Queen Mary, Lidice, Golden West, and possibly many more gave very few blooms compared with their usual performance. The bloom scapes were not in evidence when the cold spells occurred, but it seems probable that the freezing weather after the warm weather of March injured the flower bud primordia to the extent that few flowers were produced. Most of the varieties which bore only a few flowers during the normal blooming period, produced an unusually good second crop in August.

More information is needed on the effect of different conditions on transplanting daylilies. We need to know under what conditions transplanting will cause least shock to the plant and what the conditions are which make for optimum recovery from transplanting. If we had more information concerning the effects which certain conditions produce, we could more wisely adapt these facts to our local weather and soil conditions. This is particularly true as to the effect of certain conditions subsequent to transplanting. In 1947 we had a chance to make some observations on the effect of the time of transplanting. Those plants that were divided and transplanted in August 1946 did not go through the winter in good condition. Although we expect some of the fleshy storage roots to die after transplanting, a much larger proportion than usual of

these roots died and rotted. The plants were consequently weak and small. When this condition was noted in the spring of 1947, other plants of the same varieties and having similar nutrient conditions but which had not been transplanted in 1946, were dug and the roots examined. They showed good root development and good general vigor. It is probable that unusual autumn and winter weather conditions were responsible for these poor transplanting results. Probably the wet autumn weather prevented soil aeration to an extent that was harmful to the old roots and inhibited new root formation. The subsequent winter cold and wetness probably also had an additional harmful effect on such weakened plants although not affecting the non-transplanted ones. Usually those plants which are transplanted as early as August make a good showing the next year. We have repeatedly advised against late fall transplanting in this locality. Because of the few seasons, such as 1946, when August transplanting gave poor results, spring is probably preferable to mid-summer for transplanting daylilies in this locality. However the gardener has only a brief time in which to get his work done if he attempts spring transplanting. The ideal time for transplanting would probably be a time after the danger of heavy freezing of the ground and consequent cold injury to the crowns of newly transplanted plants is over but before the extensive development of new roots and shoots. Even though one may not be able to divide and transplant at the optimum time in the spring, it seems that under our conditions spring transplanting is probably preferable to mid-summer. This schedule makes certain that the plants will become well established before winter.

A word here about the importance of the light-yellow daylilies in the color scheme of the garden may not be out of place. In the general perennial garden, light yellow complements blue and purple. One can scarcely imagine a more attractive picture than the lemon yellow *Flava* with light blue iris. Later in the season when the bearded irises are gone but other blue flowers are in bloom one may use the beautiful *Patricia* or still later he may use *Dorothy McDade* as a complement for the blues and purples. Light yellow is also pleasing with pink flowers, such as phlox, especially if there is plenty of green foliage or light blue flowers are near the pink and yellow ones. Light yellow is very important for tying the orange colors in with other colors in the garden. Since yellow is analogous to orange it blends that color in with reds or pinks. The use of the light yellows prevents the feeling of rustiness which certain orange tones give with blue. Since the plain light yellows are so beautiful and so important in the color harmony of the garden, they might well receive more attention from the breeders. Gardeners would like to have light yellow daylilies that cover a longer blooming period and have more abundant blooms, that are more resistant to fading by the sun, that have better finish and substance. Most of the light yellows now in cultivation have some objectionable features that might be corrected by breeding. They all appear to have some inheritance making for burning in the hot sun. The light yellows are the main varieties that have a pleasing fragrance. The species *H. citrina* is very fragrant and is also a night bloomer.

Perhaps an hereditary character from *H. citrina* carries the genes responsible for the early opening in the morning and early fading in the evening and the burning in the hot sun which such a variety as Modesty shows. The light yellows that have proved best in our plantings are, in the order of blooming: Flava, Modesty, Pale Moon, Princess, Patricia, and Dorothy McDade. It seems not improbable that before long the season will be covered by yellow *Hemerocallis* which have the exquisite light yellow color of Pale Moon, the finish of Patricia, and the floriferousness of Circe or Mrs. W. H. Wyman.

NOTES ON THE 1948 DAFFODIL SEASON

GRANT E. MITICH, *Chairman,*
Narcissus Committee,
Canby, Oregon

The abnormal lateness of our season in Oregon may be indicated by the fact that as I start writing these notes on May 19th, I have before me some fresh blooms picked today. Generally there are few blooms left after the first of May other than perhaps *N. poeticus recurvus*. Of those before me now, one is a small crowned green-eyed leedsii from Cushendall x Cantabile, and another, a pretty small double all white flower from the same cross. Quite a number of seedlings from Addio, a very late 4b, are yet in good condition. In our main field there are still a few blossoms of Frigid open although they have lost their original pristine beauty due to age and the buffeting of wind and rain.

With the ushering in of the new year, the chances of an early season seemed most auspicious as there had been an abundance of moisture and very little frost. A pot of *N. minimus* placed on the north side of the garage with no covering nor protection had buds nearly ready to split their spathes on January 10th. As colder weather was in the offing, this pot was taken indoors and the first flower was open five days later. From that date virtually nothing more opened other than *N. cyclamineus* and *Mite*, a cyclamineus hybrid, also potted and taken inside, until about the middle of March when February Gold, Forerunner, and Malvern Gold started opening. A few days later, Fortune, Whiteley Gem, and other earlies joined the procession but it was not until early in April when a few warm days at Easter brought out quantities of bloom. There were no extremely cold days but much alternate freezing and thawing conspired to hold growth to a minimum.

Young seedlings were damaged somewhat, as due to the mild weather in the early part of the winter, fall sown seed started germinating early and there were some casualties resulting from the heaving action of the frost. Not many of those covered by sash were damaged, but even second year seedlings left unprotected were in some instances broken off. Named varieties and larger seedling bulbs were uninjured except that foliage tips in some instances were softened and made susceptible to scorch.

While the season was late and many early and midseason varieties were on together, the flowers as a whole were of about average quality,

and as always, there were a few varieties that were finer than we had previously seen them. I think the yellow trumpets were hardly up to par and a number of the white trumpets and large leedsiiis were lacking in their normal size and purity, but others performed beautifully. There was a tendency toward roughness in certain normally smooth flowers, induced no doubt by the long period of growth before opening.

We usually get less excited about the yellow trumpets than most of the other sections. Even though more of these are grown than all the other groups combined in commercial plantings, improvements are difficult to achieve. Diotima and Ben Hur are still among the best for early large flowers. Camberwell King has better form and texture and is one of the most beautiful of the yellow trumpets but unfortunately the stem is not as strong as it might be wished. Of medium height and blooming quite late, Kingscourt gave very nice blooms this year. It appears that Hallmark and Mortlake will be among the best garden flowers, and at the same time they are of exhibition quality. While we have not grown Frontier and Moonstruck long enough to fully acclimate them, they look promising, the latter being very large and of fine form, the color being an attractive sulphur or greenish lemon, considerably deeper in tone than Content.

Among white trumpets, Cantatrice remains near the top for beauty; Kanchenjunga and Broughshane for size and impressiveness; Ada Finch for earliness; Beersheba for quality at a moderate price; while Pearl Harbor and Silverdale are excellent garden flowers. Could we combine the good qualities of all of these in a flower that would give consistently good performance in all Daffodil growing sections of the country we would have achieved an ideal!

Most of the bi-color trumpets are lacking in some quality. Those which possess most merit have insufficient contrast to be distinct bi-colors. Be that as it may, there are some magnificent flowers in this section. Trousseau is a grand flower of splendid proportion and quality with intriguing color. In inclement weather the buff cheese tone of the trumpet is not always present but the other good qualities make it most desirable anyway. We highly esteem Content for its own beauty and for its value in breeding. Trostan is another excellent flower but none of these show much contrast in color. Rather short of stature and medium in size, Sincerity is of beautiful form and proportion with smooth finish. Effective as the name implies is a brilliant contrasty flower but in common with many of its class seems not to have a strong constitution. The beautiful large Spitzbergen should not be omitted although it could almost as well be called a white trumpet as a bi-color.

In considering the incomparabilis section, only a few will be mentioned although their numbers are legion. Those who acquire new red and yellow Daffodils thinking they will all be better formed more highly colored editions of Fortune will be due for disappointment as few of them possess the size and innate vigor of Fortune although many have better form and more color. Narvik certainly one of the best in that it has excellent form, jewel-like brilliancy of coloring, and extraordinary lasting

power; moreover, it is a rapid increaser and good grower although it may not satisfy those looking for the largest of flowers. Others with brilliant coloring and good form include Alemein, Bahram, Indian Summer, and Klingo. Krakatoa did not have its customary brilliance this year, perhaps due to the cool damp weather preceding blooming, a condition that fosters high coloration in some Daffodils. Not as highly colored but among the best in quality are Diolite, Hugh Poate, and Aranjuez. For exhibition, the perfectly formed flat cupped varieties Dunkeld, Garland, and Tamino are most effective. We would not want to be without some of the older all yellow incomps. such as Crocus, St. Issey, Trenoon, Carlton, and the very early Malvern Gold but with a trio composed of Galway, Golden Torch, and Sligo we have flowers that it appears may be difficult to improve. If we can achieve this quality in trumpet varieties, a real advancement would be made. Then there are the bi-color incomparabilis and among these we have some of our finest Daffodils. We still place Bodilly and Polindra near the top in this section and it will be long before we would want to part with the entirely different older John Evelyn. The newer Statue, Tramore, and Dunmore give much promise. Fermoy was quite the most striking big red and white flower we had this year. Kilworth looks very good. Red Hackle is a flower of exhibition quality and with grace of form that would make it a delightful cut flower. Of those with red rimmed cups, Tuskar Light is most striking.

Good barriis are not so plentiful. The best of those with yellow perianths is Chungking. Market Merry is very good but should perhaps be included in the 2a group. Numbers of good 3b's are appearing of which Limerick is likely the finest. Bravura, Crete, Paprika, Otranto, Tebourba, and Matapan are excellent red cupped flowers, much better than the older members of this group, the first two especially giving outstanding blooms. Blarney with its apricot salmon crown is one of the most lovely of all Daffodils and as it has performed here thus far should be one of the most lovely flowers for cutting.

So different in form from most other leedsiiis as to make one think it should be with the 2b's is Green Island whose very circular perianth is reminiscent of Garland's as well it might be in consideration of their pedigrees. Green Island was not as smooth this year as normally, perhaps due to seasonal conditions, but was a magnificent flower nevertheless and should be of immense value for breeding. In the pure whites, perhaps Ludlow would be our choice although Zero would press it closely for position. Killaloe was not quite as good this year but it is doubtful if we have ever had any finer white flowers than it gave us a year ago. Although different, Rostov and Truth rate highly and we certainly look on Brunswick as one of the finest. It is in this group primarily that we have our best pinks although several good ones are classed with the bi-color trumpets. Wild Rose is just about tops for color while Rose of Tralee is one of the best in form. Mabel Taylor is certainly the most striking with its rosy pink banded heavily ruffled crown. It needs improvement in form but will certainly be used much in breeding. While we cannot venture to predict its usefulness, we have a few thousand seedlings com-

ing on from its pollen and look for some interesting things. Lough Maree gives promise of being an interesting and pretty cut flower. While it had not been impressive before, Rosegarland was one of the highlights this year as it gave very fine blooms of good size on quite tall stems, the crowns being beautifully flushed with pink. Pink o'Dawn, Dawnglow, and Show Tower are worth while additions if only for breeding but all appear to be susceptible to virus trouble. The two former are about the best quality flowers and among the largest of the pinks; the latter having a large bell like trumpet flushed salmon pink.

If we have a favorite classification it would perhaps be the small crowned leedsiiis. Of these we like Chinese White with its large immaculate white flowers as well as any. Cushendall and its larger and later sister, Frigid, are truly dream flowers. Polar Sea, Silvermine, and Foggy Dew are a lovely trio of green eyed pure white flowers. Glenshane and Sylvia O'Neill are excellent alike for exhibition and decorative use. Moina and Dreamlight with their salmon orange rimmed eyes are lovely indeed.

We have grown comparatively few recent things from the other classifications but suffice it to say that we like Pepys and Mite of the cyclamineus hybrids; Cherie, Trim, Trevithian, and Golden Perfection of the Jonquils; Smyrna and Cantabile of the poets; and Swansdown of the doubles.

Much as we are interested in the best of the named varieties, we give priority in time and interest to growing seedlings. When a lot of seedlings comes into bloom we may look back with regret and wonder why we made such a cross, and not infrequently do we come to the conclusion before blooming age is reached that certain crosses were a waste of time, yet we have not been able to resign ourselves to their discard before blooming. Our good friend, Mr. Frank Reinelt exercises better judgment in such a situation. We can strive to rectify past errors but since *errare humanum est* we can anticipate that only a few of the crosses we make will give good things. 1948 gave us rather fewer good new seedlings than normal perhaps but there were several that looked promising. Out of King of the North x Content came several very nice sulphur colored flowers, one being very tall and strong stemmed with a flower of excellent form, the trumpet becoming almost pure white inside. Besides its novel coloring it had good substance. It was quite the most striking thing in its color that we have seen. There were quite a number of fairly good pink seedlings this year but two of the best were from a seedling of White Sentinel x Mrs. Backhouse crossed with Wild Rose. One of these in particular was deeper in color than anything I had previously seen being much deeper pink than Wild Rose. It was not very large but being in its fourth season or a three year old bulb as some growers would designate it, we look for more size another year. We had a very pretty white 4b from Alberni Beauty x Sylvia O'Neill and another quite good one from Dreamlight x Sylvia O'Neill. Several pretty white green eyed flowers came from Cushendall x Cantabile. A quite unique large cyclamineus hybrid came from Mite x Beersheba. There were numbers

of red and yellow flowers but nothing distinctive from what we already had.

While the Daffodil season just past certainly was not that perfect one that we always hope for and the percentage of good flowers may not even have been up to normal, yet we had a quota of good flowers and we will look forward anticipating a better season next year with more outstanding blooms and particularly that seedling without a fault!

NARCISSUS NOTES IN 1947

J. S. COOLEY, *Maryland*

In 1947 there was an abundance of fine flowers in our plantings. Many gardeners, however, complained of the poor yield of flowers. This was especially true in cases in which the plants had excessive competition because they were too thick. The dry weather and high spring temperatures of previous years together with other unfavorable conditions were probably responsible for the poor yield of flowers.

The development of the red in the cup of such varieties as Dick Wellband, Francisca Drake and Fortune is an interesting study from year to year with different prevailing conditions. Some years the red color is very pronounced and some years it is decidedly lacking, so much so that one often wonders if his plant is true to name. The red cups were unusually colorful this year. The complex of environment that favors red color prevailed to a remarkable degree this year. There are probably a number of conditions that must react on one another to make this end result of a red or orange color in the cup. Observations seem to indicate that adequate moisture and a cool temperature are important elements in the development of red color in the cup.

Popular interest in *Narcissus* seems to be on the increase. The enhanced interest on the part of garden clubs in *Narcissus* shows together with the extensive advertising of the nurserymen would be expected to promote more interest in this group of plants among the flower lovers. At present one can not help noting the small number of gardens in which these flowers are growing. A casual survey at flowering time of the gardens of any community is likely to reveal that only a small proportion of the homes have *Narcissus*.

ALSTROMERIAS IN MICHIGAN

FREDERICK W. BOEHRINGER, *Michigan*

The Alstromerias took my fancy in 1941 when I received a catalog from Oakhurst Gardens with colored photos of the Chilensis hybrids. Having a greenhouse for winter growing plants, I bought a few roots, and grew them in pots the first year. This did not prove very successful as I was too busy in the spring of the year to give them all the attention that they needed. However, they did flower and produce small clusters. They were beautiful in vase arrangements and corsages. I left them in the pots until autumn and then decided to plant them in some available bench space. This house was somewhat cooler (50° F., nights) all winter and they did much better under these conditions. I had heavier clusters of blooms and the colors were better.

The *Alstroemeria* species and hybrids that I have grown do not seem to be particular about the soil used. I grew them in light sandy loam, giving them a light application of a complete fertilizer during their growing season. They began flowering in April and lasted until June. I have added many species and varieties since, and am now growing *Alstroemeria chilensis*, *A. Ligtu*, *A. angustifolia*, *A. pelegrina alba*, *A. Hookeri*, *A. tricolor*, *A. violacea* and *A. haemantha*. I also had *A. pulchella* and *A. aurantiaca*, but prefer the other colors. *A. aurantiaca* is a good durable bloom and is used a lot for bouquets. *A. pelegrina* started flowering the middle of March this year and has always been earlier than the other species and varieties.

This year I have some seeds of several crosses that I hope will give me some interesting hybrids. I also intend to try some roots out of doors to test their winter hardiness here.

BRODIAEA LILIES

ELMER C. PURDY, *California*

Born in a home surrounded by gardens to which came by purchase and contribution for trial and evaluation a great many of the bulbous plants hardy in the temperature zone, as a toddling youngster, I was taught to view each objectively and to consider its particular merits.

After 45 years of youth and adult life among flowers, I still love them all and know no favorites, yet some have qualities that particularly commend them and among bulbous flowers none is more dainty, easily grown, either in the garden or in pots; nor are there any more lasting either in the garden or as cut flowers than the BRODIAEA LILIES.

The botanical treatment of this group has been somewhat confused and complicated through the years. Some botanists have called them all *Brodiaea*. One botanist rather recently has gone back to the decision of older botanists and divides them under six generic names.

In a more recent treatment following an intimate study of fresh material, Dr. Robert A. Hoover separates them into four generic groups—

Brodiaea, *Triteleia*, *Dichelostemma* and *Triteleiopsis*. In cases where botanical accuracy is required, the correct scientific names should of course be used, but as a popular group name, BRODIAEA LILIES is appropriate.

The four genera included in the BRODIAEA LILIES comprise some 30 species found on the Pacific Slope of North America with the majority indigenous to California and Oregon.

They are very widely distributed and in California no section is destitute of one or more species.

The BRODIAEA LILIES were formerly placed in the *Liliaceae*, but Hutchinson (1934) transferred all of the *Allieae* to the *Amaryllidaceae*. The rootstock of the BRODIAEA LILIES is a corm and not a bulb, and the former term will be used in this article.

The leaves are grassy and basal, while the naked stem, in most species but one to a corm, is quite slender yet wiry and stands erect. There are from a few to many flowers borne in an umbel. In one group the pedicels are very short and so crowded as to form a dense head of florets. In another group the pedicels are many and 1 to 2 inches long to form a loose globular head, while in still another group the pedicels are from 3 to 5 inches or even 8 inches long, loosely arranged to give a broadly spreading umbel of from 5 to 50 flowers.

Height varies from 3 inches in one species to 36 inches and occasionally 48 inches in another. One odd species has pedicels radiating from a stem that does not exceed the ground surface, but the oddest of all is one with a twining and climbing stem of which I measured one specimen thirty-six feet long.

Colors vary from white, pink, rose, red, yellow and through every imaginable shade of blue from soft lilac through violet to a deep purple.

In what other group indeed, can one find more variety of height, flower form and color and once you have grown them you will say—"In what else such variety of dainty loveliness?". Add to this the fact that the flowers are among the most lasting of bulbous flowers either in the garden or as cut flowers and that they are excellent pot bulbs. I am sure you will agree that the Brodiaea Lilies are an exceptionally valuable group.

Culture: So you will fully understand the reason for some of the cultural hints that follow I should tell you something of the conditions under which BRODIAEA LILIES grow in the wild.

Here in the West the summers are entirely rainless. Rains come in the late autumn and continue through Winter and Spring. In the milder sections the corms start root action with the first autumn rains and leaves may show by mid-winter. In the colder sections root action may be deferred until winter or even early spring and the leaves may push through the soil as spring warmth comes.

Stems push up in late spring, which may be March in warm regions and late May in cold ones. They complete their flowering period and soon thereafter ripen to the ground so the corm has a complete summer rest.

In the West a garden must have some watering throughout the summer while in all states East of the Rockies there are summer rains. With good drainage the corms of BRODIAEA LILIES stand summer moisture not too greatly harmed and in past years I have stated they may be left in the ground. However, I have come to the conclusion that nature knows best, and that if we are to afford the corms the greatest possible energy for future bloom and give them long life that we must give them a complete summer rest. This means either digging the bulbs at once they are ripe and storing them dry for replanting in October; or planting in pots or boxes, which may be sunk into the open soil in October and which may be removed when plants are ripe to be stored in the dry over summer and may again be sunk into the open ground in October. Many of the finer species are not costly and many gardeners prefer to leave the bulbs in the ground and buy a few new bulbs each fall as they do with tulips and hyacinths.

Soils: BRODIAEA LILIES are found in a wide variety of soils, always well drained but many of them very poor soils. All will thrive in any well drained soil and a good loam or clayish soil, lightened with sand or grit suits them perfectly. They do not like heavily manured or fertilized soils nor soils too rich in humus but some manure or complete fertilizer, well mixed with soil, and placed under the corms and separated from the bulb by $\frac{3}{4}$ inch of clean soil will enhance results.

Situation & Planting: Unless planted in considerable numbers and quite thickly BRODIAEA LILIES are of little value for color massing. They are much more effective planted in little colonies in rock garden, in odd corners or in crevices of natural rock. They are lovely among ferns, heuchera, columbine or other slender plants. They should never be planted under or among rampant or choking plants that will over run and smother them. Corms may be spaced 2 to 4 inches apart, and covered 2 to 3 inches over tip of bulb; 3 inches in very light soils.

Brodiaea Lilies are perfectly hardy without protection. The tender shoots cannot push through a mulch in case of failure to remove early enough in Spring and would hence be smothered. I advise against protection or mulch. Planting time is much more important.

Time of Planting. Corms you order will be received some time after Sept. 15. In mild climates they may be planted at once. The corms are packed dry and retain full vitality even if planting is deferred up to Nov. 15. In the event of early rains and a warm autumn, corms planted early may start prematurely. Therefore in all colder regions, (and in this I include all but the Southern and Pacific States), I recommend that planting be delayed until really cold weather from late Oct. to Nov. 15. Nature takes care of her own and the late planted bulbs will remain dormant over winter to start root action and sturdy growth when soil conditions and temperatures are proper just as do your local native bulbs in the wild.

Watering. Although BRODIAEA LILIES may be naturalized with a minimum of natural moisture, in the garden results are enhanced by giving them abundant moisture whenever natural moisture is deficient

during the growing and flowering season after which they should be dried off.

In Pots or Boxes: The corms will do well in ordinary friable garden soil. One may use a very rich potting soil provided the corms are surrounded with sharp sand. Potted BRODIAEA LILIES may be sunk into the garden in late Oct. or be placed in a cold frame.

In Greenhouse: The corms may be potted and set aside to root just as you would handle tulips or other potted corms and bulbs. When well rooted they may be brought into heat gradually and finally in the house at 55 to 60 degrees. They will perish with bottom heat or heavy forcing. All that you can do is to hasten bloom by bringing spring conditions to them sooner.

The following is a list of recommended species and forms limited somewhat to those usually obtainable from dealers with the mention of a few very desirable ones not currently to be had. Descriptions are popular rather than botanical. Those who would like to know the other species and those scientifically inclined who prefer botanical descriptions are referred to the monograph of Dr. Hoover. As already indicated, botanically there are four genera, *Brodiaea*, *Triteleia*, *Dichelostemma* and *Triteleiopsis*, but horticulturally they may be considered as a single group, the BRODIAEA LILIES. On an ecological basis they may be grouped into HARVEST BRODIAEA LILIES and WOODLAND BRODIAEA LILIES. Until Dr. Hoover recently straightened out the matter, the botanical names in some cases were confused. In the list below, the synonyms are given in parentheses after the correct botanical names. Species starred (*) are not currently obtainable.

HARVEST BRODIAEA LILIES

These are found in nature in open fields in full sun and often in rather heavy soils to which they are tolerant. They will stand light shade and the flowers last longer there. All flower very late, mid-June through most of July in California.

Brodiaea elegans (syn.—*Brodiaea grandiflora*) ELEGANT BRODIAEA LILY. Umbels 3 to 11 flowered, the flowers standing erect on 6 to 12 inch stems are very glossy deep blue and very lasting. Naturalizes easily in any clay soil.

Brodiaea californica; CALIFORNIA BRODIAEA LILY. Stems 1 to 2 ft. high and stout; bear erect umbel of a few to 12 flowers of deep blue tinted lilac in one form while in another the flowers are soft lilac-pink. Likes very liberal moisture. One of largest and tallest species. Flowers very late.

Triteleia peduncularis (syn.—*Brodiaea Eastwoodii*). To 18 inches tall with an erect dense umbel of milky white, lilac-veined flowers. Loves a moist spot where it rapidly increases from bulb offsets. July.

WOODLAND BRODIAEA LILIES

These are usually found in open woods but are very often seen on sunny slopes or in open fields. They do equally well in sun or shade but for lasting blooms a situation in light shade is preferable.

Triteleia Bridgesii (syn.—*Brodiaea Bridgesii*). This grows from 8 inches to as much as 24 inches in height. Umbel is many flowered and broadly spreading, often with as many as 50 flowers. Flower is soft violet blue with a reddish violet over shade, a combination very hard to describe but very lovely. Blooms May-June according to season and region.

Dichelostemma pulchellum (syn.—*Brodiaea capitata*). Slender stems 6 to 15 inches tall, the flowers in dense heads of violet blue. This is unique in producing from two to as many as a dozen stems to each bulb. One of the easiest of all to grow.

**Dichelostemma idamaia* (syn.—*Brodiaea coccinea*) FIRECRACKER LILY. Stems from a foot to three feet tall with pendant umbel of long vivid crimson flowers so greatly like the bunches of Chinese firecrackers that FIRECRACKER LILY is the popular name throughout its extended range. It is native entirely of open woodlands. Both unique and lovely.

Triteleia crocea (syn.—*Brodiaea crocea*) GOLDEN BRODIAEA LILY. Four to 12 inch stems with umbels of 4 to 8 or even 15 flowers, of golden yellow, with a purple mid-vein. A very hardy species.

Triteleia hyacinthina (syn.—*Brodiaea lactea*). There are several varieties varying in height from six to 24 inches but the more usually obtainable form is 6 to 12 inches high with a rounded umbel of from 10 to 40 flowers, pure white with a greenish mid-vein. Naturalizes readily both by offsets and self-seeding.

Triteleia laxa (syn.—*Brodiaea laxa*). One to two feet high with a broadly spreading umbel of 8 to 50 flowers of clear soft blue. One of California's finest blue flowers, and very lasting.

Dichelostemma volubile (syn.—*Brodiaea volubilis*). CLIMBING BRODIAEA LILY. This is commonly called the "Twining Hyacinth." It usually grows under scrub brush and its long twining and climbing stems push up through the brush so the dense heads of lasting rose-pink flowers are borne over the brush in full sunlight. Must be grown where it can climb or be given a support.

**Triteleia ixioides* var. *scabra* (syn.—*Brodiaea ixioides* var. *splendens*). This is popularly known as "GOLDEN STARS." Umbels are rounded with flowers upright like stars of deep creamy yellow edged golden yellow. Very lovely and it is hoped it will be available to gardeners before long.

No BRODIAEA LILY is without beauty and each has its own character and individual loveliness but in a popular article there seems no point in describing the many species not procurable by gardeners and I can only express the hope that some day there will be.

No words can adequately describe the grace, loveliness of form and color of each of these fine species. They must be seen to be fully appreciated and I hope I may lead some who have read these words to venture and thus share some of the enjoyment I have had through each of many Springs as each of these lovely species came into flower.

CRINUMS FOR GARDEN AND GREENHOUSE

WYNDHAM HAYWARD, *Florida*

The CRINUM LILIES are most certainly "he-man's" bulb, many of them ranking among the largest bulbs in the world, and two of them, *Crinum asiaticum* and *C. amabile*, growing to a truly impressive size that is no less than "colossal," as they say in Hollywood.

On the other hand there are species that are small and dainty, blooming nicely in a six-inch pot. But most of them are suitable only for culture in the open ground, and that limits their usual garden use to the lower South, with two or three exceptions, notably *Crinum bulbispermum*, (formerly known as *C. longifolium* and *C. capense*) and some delightful hybrids of this species, which have inherited some of its hardy character, as *C. Powellii* and its congeners. Figure 204 shows a *Crinum* received in a lot of bulbs from Kenya, and it may be a hybrid for its seeds are infertile. Figure 205 shows an unidentified *Crinum* species from Burma.

A good many garden lovers in the Lower South have seen and lived with Crinums all their lives, without knowing the bulbs by that generic name. They are fairly common along the coastal lowlands of the South Atlantic, around Florida and the Gulf Coast to Mexico. In warmer parts of the upper South, and up into Oklahoma and Missouri, a few of the tougher species may be found in protected locations. The species *C. bulbispermum* and its hybrids are half-hardy and will survive in gardens with some protection up to Philadelphia and even New York. In cold climates where the ground freezes they can be covered with sand or ashes in winter, or the bulbs can be lifted and stored dry in a warm part of the cellar over winter.

The Crinums are showy things, for the most part easy to grow and long lasting. They propagate readily by offsets in the case of mature and well-established bulbs, and reward the garden lover with a rich harvest of floral beauty and perfume as well, in some cases, besides handsome greenery.

They are the lazy man's bulb supreme, as they will thrive for years in any good soil with only a modest weeding and cultivation now and then, when the spirit moves the gardener. Most of the species will grow faster and bloom more "splendiferously" in moist locations on heavy ground, but the average *Crinum* takes well to ordinary garden soil, even high sandy land. On the higher and dryer locations the Crinums may require more watering and more fertilizer than in a lakeside location, but they will still give a good account of themselves. If given half the care and attention that the average rosebush receives, any self-respecting *Crinum* will return big dividends for the investment.

Many garden-lovers have found that they could do pretty well with a planting of Crinums all alone, with nothing else in the bulb garden, but that would require a large supply of bulbs. The Crinums are herbaceous plants, with showy, liliun-like white, pink, rose or striped flowers, having long or short necks and producing bulbs which weigh up to 25 pounds or more each in the largest species.

Most of them are spring and summer blooming. A few are more or less deciduous, losing their leaves in autumn and winter. They are native to both hemispheres and at least one species inhabits the limits of the continental United States, *Crinum Americanum*, with its pretty, pinkish white, star-like flower, found growing along stream banks in the deep south from Florida to Texas. In Florida we have seen it along the St. Johns River and southward to the Everglades where it grows by the thousands. *Crinum americanum* is a water-side or aquatic plant, and requires a rich, moist soil. It is a shy bloomer and does not adapt itself readily to garden conditions or pots, and is not recommended for general garden use. The bulbs are small, leeklike, and stoloniferous, seldom more than an inch or two in diameter, and a foot tall, to the top of the narrow leaves.

Most popular today are the *Crinum* hybrids, of which dozens have been reported in horticultural literature since the time of Dean William Herbert, the great Amaryllis hybridizer and student of the early 1800's. But unfortunately, most of these hybrid *Crinums* have been lost with the passing years, or at least lost by name, and their origin remains cloaked in mystery when they turn up. The *Crinum* collector who ranges far and wide over the countryside of the Lower South comes on *Crinums* here and there that do not answer the descriptions of any known species and which patently are hybrids. Some of these may be natural hybrids of self-sown seed, created by some passing butterfly, or they may be remainders of some 19th century hybrid of the many reported in various gardening publications in the last 150 years. It is impossible to tell.

The two largest *Crinums*, *C. asiaticum* and *C. amabile*, are somewhat alike in foliage and bulb character. They are excellent for landscape specimens, foundation planting and sentinel lines. They can even be planted as a hedge or accent clump at the side of the lawn. *C. asiaticum* has large umbels of white flowers with narrow, linear petals. There may be 30 or 40 in an umbel, on stems two to four feet tall. The bulb is leeklike, 1½ to 2 feet long, and bears a head of many three-to-four-foot leaves. The flowers are very fragrant.

C. amabile is supposed to be a natural hybrid of *C. asiaticum* and some milk-and-wine-colored species. It is like *C. asiaticum* with larger flowers, having petals purple red on the back and lighter on the inside. It has a strong perfume, and a single scape may be too much for a room. The individual flowers of this and the preceding species may be used in small vases around the house, as the huge umbel presents quite a problem to the flower arranger, while very showy in the garden. Blooming scapes of *C. amabile* plants need a strong support as they weigh five to ten pounds at maximum and flop to the ground when the flowers open. When grown in poor soil the bulbs and scapes are not so portentous.

There is a large group of *Crinum* species which may be classed horticulturally as "MILK AND WINE LILIES," and are popularly known under that name by many garden lovers. They include the showy *Crinum scabrum*, *Crinum zeylanicum*, common in the Florida countryside, *Crinum Kirkii*, *C. erubescens*, *C. Sanderianum*, *C. fimbriatulum*, etc.,

more or less similar in general characters, having umbels of rather trumpet-shaped flowers with pink, rose or rose-purple stripes on the petals, and blooming in late spring and summer. They are the commonest of the *Crinums* and there is much confusion in their nomenclature in gardens. At the present time there is not sufficient data available to assure prompt, certain identification of most of these "MILK AND WINE LILIES," which are mixed and scattered far and wide over the landscape, particularly on old country places, where long rows may be seen blooming in early sum-



Fig. 204. Infertile *Crinum* received from Kenya; possibly a hybrid. Photo by Wyndham Hayward, Florida.

mer throughout the Lower South. They make excellent cut flowers and many of them are perfumed. Country folk call them ANGEL LILIES, WINE LILIES, HONEY AND WINE LILIES, etc. The flowers of a few species are wide open at their best, almost like *Amaryllis*. Practically all species are mainly night blooming, that is, they open their flowers in the early evening, are in best condition in the late evening and early morning and the individual flowers usually fade somewhat during the heat of the

following day. Early in the morning is a good time to see them at their best.

Two other interesting species are *C. Moorei* and *C. giganteum*. There are several species not well understood in this country close to these. *C. Moorei* is possibly the most delicately beautiful species of all, in flower, with bluish-pink tinted trumpets on a slender scape above a handsome crown of leaves. The bulbs have a decided, rather long neck, and the foliage requires shade. It is deciduous and the bulbs are dormant in summer. Hence, as tender tropical plants (from South Africa) they must have protection in winter from cold damage to the foliage or the growth will suffer. It is an excellent greenhouse plant, too. It is one of the parents of the interesting bi-generic hybrid with *Brunsvigia rosea* (Lamarck) Hann. (syn. *Amaryllis belladonna* Ait., non Linn.) called *Crinodonna Corsii* Stapf (syn.—*Amarcrinum Howardii*) made first by the late Ragionieri and again by the late Fred Howard.

The infertile clone resulting from the cross made in Italy by Attilio Ragionieri is regarded as inferior in garden quality to *Crinodonna Corsii* c. FRED HOWARD. It blooms in late summer with a lovely umbel of pink flowers and the same heavenly perfume as the Cape Belladonna. It too is infertile.

Crinum giganteum (Figure 206) is not a huge bulb, but attains large proportions. It has a habit of blooming in midwinter during warm spells, but must have protection from frosts or the foliage will be lost and the bulb growth retarded. Its flowers are somewhat tulip-shaped, white with spreading petals. It is more particular in habits than most of the other *Crinums*, the same as *C. Moorei*, and enjoys part shade in rich, moist soil.

The ubiquitous *Crinum bulbispermum*, (*C. capense* and *C. longifolium*) is found in many old gardens over the South up to Washington and even farther North. It has characteristic glaucous-green foliage, with flowers rather funnelform, a dozen or more to the umbel, pink striped, or pure white in the variety *alba*. This may well be the commonest and most widely dispersed *Crinum* in the country. The pink type seeds profusely and has entered into the parentage of many of the hybrids, mainly the *C. Powellii* group.

This *Powellii* group contains several of the most valuable garden crinums for the greenhouse and Lower South, including the pink *C. Powellii* (type), *C. Powellii* var. *album*, pure white, an excellent substitute for EASTER LILIES in the spring, also *C. Powellii* var. *Krelagei*, a lovely pink produced in Holland, and Cecil Houdyshel's stellar production, *Crinum* c. CECIL HOUDYSHEL. Mr. Houdyshel is a California hybridizer who has introduced a number of fine hybrid crinums, including VIRGINIA LEE and GORDON WAYNE, but his CECIL HOUDYSHEL, a vigorous, handsome bulb, with tall stems and large umbels of rich pink, rates just about tops in the *Crinum* field today. A mature bulb may be six inches in diameter, and will bloom half a dozen times a year, starting in early spring and continuing into middle summer.

There are two or three *Crinums* found in the South which are related to *C. giganteum*, one of them popularly known as CHRISTOPHER LILY. It blooms in summer only once or twice a season, multiplies rapidly, and has smaller bulbs than the true *C. giganteum*. As in the case of *C. giganteum*, the anthers of the flowers turn black after shedding their pollen, which gives a striking touch to the pure white flowers. The late Theodore L. Mead of Oviedo, Fla., a pioneer horticulturist who once had a large



Fig. 205 *Crinum pratense* from Burma. Photo by Wyndham Hayward, Florida.

Crinum collection, thought this dwarf *C. giganteum* type was a hybrid of some kind.

The hybrid ELLEN BOSANQUET, a deep wine-colored *Crinum*, is one of the best creations of the plant breeder's art in this genus. It was originated along with the Powellii type, LOUIS BOSANQUET, by the late

Louis Percival Bosanquet of Fruitland Park, Florida, and is now well known around the Gulf Coast. The bulb is large and vigorous, and the flower umbels generous, exotic and colorful. EMPRESS OF INDIA is a rare hybrid of the MILK AND WINE type, having striking large flowers, up to eight or nine inches across when fully expanded. It is more strictly a night bloomer, as is a California hybrid, WHITE QUEEN, which may be



Fig. 206. *Crinum giganteum* under outdoor culture in Florida. Photo by Wyndham Hayward, Florida.

one of Burbank's productions. This has numerous trumpets of a rather drooping form of a lovely porcelain white. It is beautiful in the late evening or early morning, but fades quickly with the hot sun of summer. Other desirable hybrids include the rare *Crinum Zimmermani*, produced

by E. P. Zimmerman of Carlsbad, Calif., and the late Dr. Henry Nehrling's choice jewels, MRS. JAMES HENDRY and SOPHIA NEHRLING, with white, expanded trumpets tinged with pink. These have been illustrated in old numbers of "Herbertia."

Other popular hybrids are the richly perfumed PEACHBLOW, pinkish white, on long stems, bred by the late T. L. Mead of Oviedo, Fla., and J. C. HARVEY, a thrifty-growing pink, of shy blooming nature, said to be a California bulb originally.

GROWING AMARYLLIDS IN POTS

EDITH B. STROUT, *Chairman*
General Amaryllid Committee

I began growing amaryllids in pots because of necessity. The first amaryllids I ever acquired, some *Amaryllis xJohnsonii* and hybrids, just would not grow in our heavy adobe (clay) soil that was dry in summer and wet in winter, but by purchasing a little top soil from the florists and growing in pots I was able to control their growth better. Then in the fall of 1943 the house which we were renting was sold, and like many others during this period we were forced to move. The new house we were fortunate enough to rent was nicely landscaped and had some very nice flower borders. Not being the kind of tenant who digs up the nice shrubs planted by the landlord to put in my own particular pets, I decided to grow all my flower bulbs, including many *Iridaceae* and *Liliaceae* in boxes, pots and cans and place them in the enclosed back yard.

From my own experiences, it is my contention that any amaryllid can be grown in a pot, if the word "pot" is a general term to denote a container of some sort. Of course, like everyone, I have had some complete failures, but I believe this is my fault in not finding the right soil and moisture conditions rather than pot culture, and I shall speak of these in more detail later.

From the few books, magazines and catalogues that have come into my hands, amaryllids generally seem to have been classified into two groups, those that were tolerant of or liked their roots pot-bound, and were therefore considered easy for pot culture; and those that must be planted in free soil. Of this latter group, it is my own personal opinion that it is not the free soil that counts, but the *depth* of soil, for some of these seem to send their roots straight down rather than laterally. Still speaking in general terms, a depth of 10 inches seems to satisfy the needs of most of these bulbs wanting more root room.

One must, of course, also take into consideration the soil and moisture requirements of the various bulbs. I am sure that some of my failures to get bloom have been due to insufficient water. Clay pots dry out very quickly in my section of the country where it practically never rains from May till October, and to keep the plants moist it is often necessary to water twice a day. Putting the pots in deep dishes, such as mixing bowls, will help on this, but again the expense of the extra bowls must also be considered for the small grower who must strike a balance between get-

ting a new bulb or getting bowls! I've often found that the containers cost more than the bulbs!

Tin cans will hold the moisture better in the summer, but again they also hold it better in the winter, and our rainfall here during the months from October to May will vary between 26 inches to 76 inches. To give the pots or cans sufficient drainage so they won't be flooded when we get 76 inches of rain in 7 months, most of it falling in 3 months, also means more difficulty in keeping them wet in the very dry summers. Sinking the pots in the ground was out of the question, for the only ground available was the borders, already heavily planted. A mulch of peat moss or redwood bark was discarded as being too expensive if it was to be effective. So I've grown mine the hard way—containers set on the hard packed ground and frequent waterings in summer.

When a shortage of clay pots developed in this section during the war years, I had to resort to cans and wooden boxes. I like the wooden boxes, but they aren't as portable as pots and they do decay and this seems to encourage more bugs (which also like the bulbs), as well as a mold. The mold can be controlled by watering with a solution of Clorox using 2 teaspoons to a quart of water.

The boxes I used were those easiest to get—fruit lugs from the stores, usually about 6 inches deep. Sides and bottoms are very thin and they rot within two years and must be replaced. For deeper boxes, I used apple boxes, reinforcing the thin bottoms, or used the thick ends of orange crates to make a box 10 inches square. Boxes made of heavier wood, and painted with preservatives, would last much longer. The usual seed flat I've found too shallow to be of much service for anything.

Before listing the amaryllids individually, I want to mention that a number of bulbs, like the well-known *Narcissus*, can be made to bloom beautifully the first year they are planted in pots, but by "pot culture," I mean growing them continually in containers with no shift to free soil to "recuperate"—they must live always, year in and year out, in pots, and to be successful must flower regularly. Also, in my pot culture, I do not discard the old soil and add new each year, for I've felt pot culture should imply growing always in the same pot and soil at all times. Many of my bulbs have been in the same pot and same soil for five years and are still husky and vigorous. I do give new soil, of course, when it is necessary to transplant when taking off offsets or putting into a larger container because of increased growth. Since amaryllids are usually heavy feeders, the food in the original soil is soon used up and growing the bulbs in containers continuously means that one must fertilize heavily to supply the necessary nourishment.

I use all kinds of fertilizer, whichever seems handiest at the time; liquid cow or sheep manure, commercial fertilizer such as "Vigoro" dissolved in water, bonemeal, or "Plant Chem." If my health, as well as time, permits, I try to fertilize once a week, alternating liquid manures with "Plant Chem," for I've felt the latter could furnish some of the trace elements needed. But sometimes the pots have had to be sadly neglected for weeks and even months at a time.

Agapanthus come first in what I call the "easy group." These have been well known in colder sections as a tub plant, but the amazing thing to me was how well they behave in small containers. Dr. Traub sent me a seedling *Agapanthus* species which I potted it in a gallon can. It seemed happy there, so I didn't disturb it the first year, and the second year I

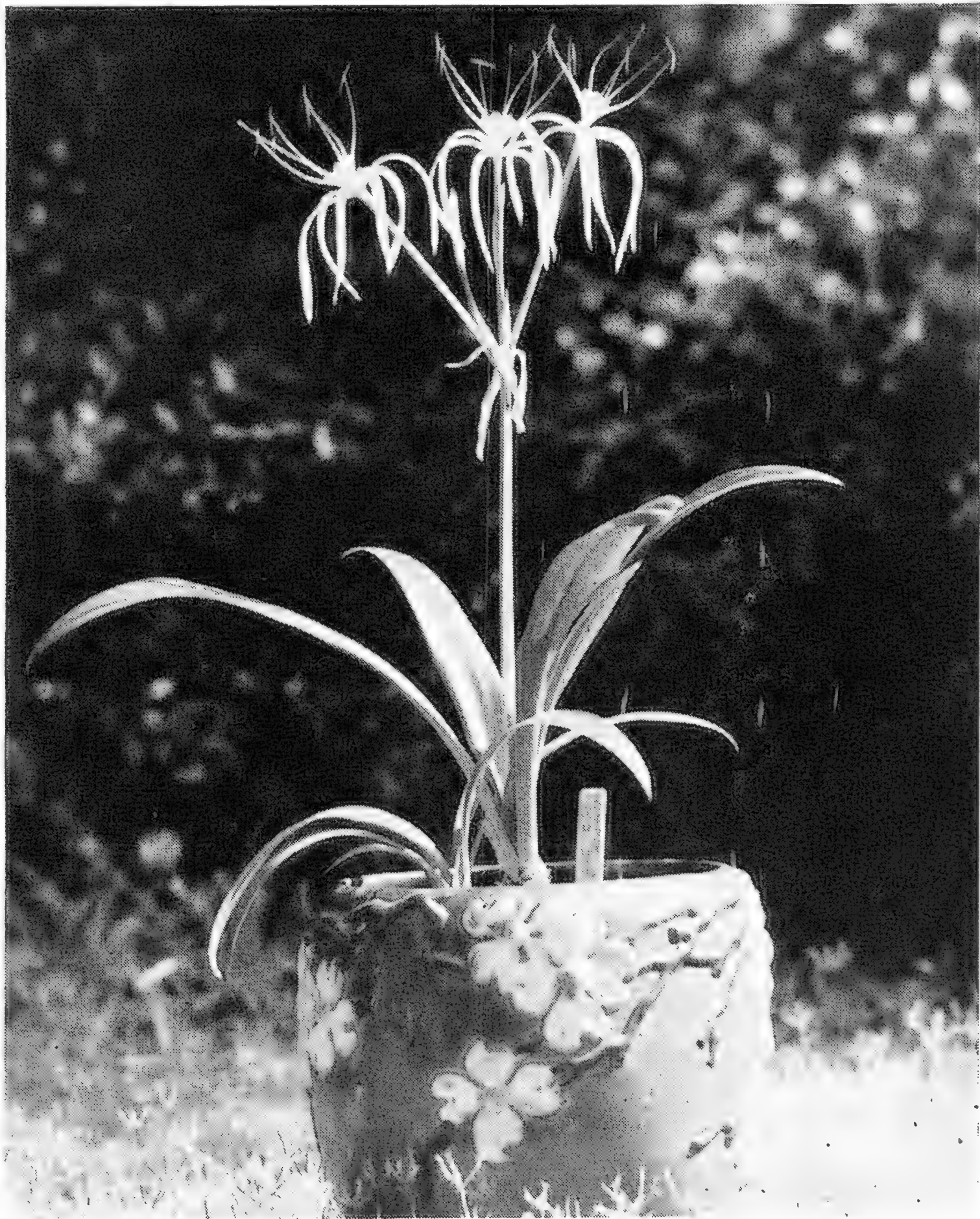


Fig. 207. *Hymenocallis caribaea* from Saba Island, West Indies. Photo by Edith B. Strout, California.

was too busy to transplant it. So I was much surprised to see it send up a stalk 40 inches high with a 10 inch umbel. No new soil has ever been added and the roots have never been disturbed. Now there are four blooming sized plants and a good number of seedlings, all in the same gallon can! *Agapanthus mooreanus* var. *minor* has five plants in a half

gallon can and bloomed well, and a seedling *A. longispathus* also bloomed in a half gallon can. Having dug *Agapanthus* in free soil and seen their big fleshy roots, I would never have believed they could bloom in such small cans, but they have and seem to like it. Of course, as is usually the case with most amaryllids, they are heavy feeders and should be fertilized well though I have given these less fertilizer than any of my other amaryllids. The half gallon fruit juice cans have greater *depth* than a clay pot of the same diameter, but I believe my success in getting these to bloom so well was keeping them well soaked in the summertime. The *Agapanthus* species from Dr. Traub particularly seems to need lots of water. Needless to say, a group of six white *Agapanthus orientalis* in a 5 gallon oil pail do very well also.

The *Allium* species should be easy in pots. *A. triquetrum* I know will grow in anything, for it seeds so easily it becomes a pest out here, though I can't help but admire its airy bells. I have had *A. tangutium* the longest, and this did very well in a fruit lug, but now the bottom of the box has decayed, so it is really only a small raised flower bed. I haven't been able to give the other alliums a fair test for I've had most of them only a year. None of them this year has been really successful. Last winter the soil in the pots of Alliums started heaving during a freeze, but the plants didn't seem to be hurt thereby. *A. oreophilum*, *A. ammodendrum* made an effort, but are not really happy, though they did bloom. *A. cernuum* and *A. montanum* all blast and I have been unsuccessful in getting the buds to open.

Amaryllis Linn. (ex hippeastrums) are well known as pot plants, the usual procedure being to leave half of the bulb above ground. While I grow most of the hybrids this way so I can use a smaller pot, I've noticed that so many of my seedlings particularly of the narrow-leaved group of *Amaryllis* will pull themselves *down* to the bottom of the can. If their urge to be below the surface is so great, I can't see why the bulbs should not be grown that way, if one had a large enough pot to allow ample root room. Those I've tried planting so all the bulb was covered have done as well, if not better, than those planted with the part of the bulb exposed. I've heard reports that these hybrids would not bloom unless root bound, but this is not true. I have sometimes planted a small bulb only 1½" in diameter in a 8" pot to allow room for future growth of bulb and offsets, and have had it bloom the first year long before the large pot was full of roots. And they continued to bloom yearly, although no new soil was added—they are left strictly alone. But these *Amaryllis*, and particularly the hybrids, are very accommodating plants, and will adapt themselves to many varied conditions, even adverse ones.

The *Amaryllis* species, however, are not so tractable. *A. belladonna* Linn. (syn.—*Hippeastrum equestre* Herb.) and its hybrids, always rot for me if planted partly exposed, but do well if covered with soil. The *A. ambiguum*, an *A. elegans* hybrid I believe, seem to want to be planted well below ground—at least I've been unable to get it to bloom in a pot. *A. elegans* I got from the West Indies and it grows and flowers, but there are few bells on the stalk and it is not particularly happy. Incidentally,

I dug some of these, and also *A. belladonna*, in the West Indies in their native habitat, and found the bulbs from 4 to 9 inches *below* the surface of the soil! I think *A. elegans* particularly should be planted deep to be happy, for then, like the lilioms, they can have cool feet but their heads in the sun, and I'm not sure but what growing them like lilioms would suit them better. Though I have a number of other species, many are still only small offsets or seedlings and few have flowered, so I have much to learn about their requirements.

Clivias are another well known pot plant and I can add little to what is already known about them. When I first bought mine, I found the roots so long that I just could not push them into an 8" pot or I would have broken the offset which had started for form, and which was pointing straight down; so I had to get a 10" pot for it. The plant (*C. miniata*) grew and thrived, but did not bloom. I had been bringing it in during our rainy winters and keeping it at room temperatures. A correspondent informed me that they must be kept at a winter temperature of not more than 45° F., or they would not bloom. So the next winter I put mine under the back porch where it could get some protection from the rains and still be cold, and since then I've had bloom every year! Whether it has been the lower winter temperatures, or the fact that by now the pot had gotten full of plants, and also roots, I do not know, but suspect it is a little of both. I now have three blooming size plants, 6 offsets, and I've removed at least four offsets. A 10" pot full of clivias, with several stalks in bloom at once, is a fine sight and can still be moved around to display to advantage. Personally, I could not carry a larger pot than 10" and consider this the largest pot that I can use.

Cyrtanthus lutescens is another well-known pot plant. When I bought my bulbs, Mr. Orpet advised me to plant as deeply as possible in a 4" pot. I did so, and have had the bulbs in the same pots (without a change of soil and have given little fertilizer) for some 4 years. I find now that I have at least 12 bulbs in a 4" pot and 15 bulbs in a 5" pot. I get scattered bloom all through the year, December, February, April, June, July, September, or what have you. When I bought these I understood that they were winter bloomers, being dormant in the summer. Since I keep on watering them, all summer, they never go dormant and buds are apt to appear at any time, temperature seeming to have little effect. I have not kept any kind of record as to how many times a year each bulb blooms, but the potful as a whole is very successful and produces blooms frequently. Slugs dearly love *Cyrtanthus* and will come to them before eating any other plants. The flower buds particularly seem choice deserts to them, and therefore much vigilance is needed in the "slug season."

Cyrtanthus angustifolia is not so easy. It seems to like a very sandy soil and only once in five years have I gotten it to bloom. It was a much more decorative garden subject than *C. lutescens* and I regret that I am unable to see its fine bloom oftener. I do not know if its failure to bloom is resentment at being confined or due to some other factor of soil or moisture.

Cyrtanthus O'Brienii looks as if it would be among the easy ones to grow, though not as prolific as *C. lutescens*. It bloomed the first year I had it, and last winter put out a bud during a deceiving warm spell, only to have a cold wave freeze the mother bulb. Now I must wait till the offsets are large enough to bloom before discovering if it will be free flowering for me or not.

Eucharis have been easy for me. The bulbs I have come from Saba Island in the West Indies, and though I have not been able to get them identified, I believe it is probably the common *E. grandiflora*. These bulbs are supposed to be planted 4" below the surface, and have plenty of root room below, a 12" deep container usually being recommended. My own experience has been otherwise. When I received them, they were sent as "white lilies" among a large shipment of assorted *Amaryllis* bulbs. Though I had never seen a bulb like these, I knew they were not *Amaryllis*, but I planted them in the same soil and in the same way as the other *Amaryllis* received. Some had flowered during the two months journey in the mails, and most had started leaf growth. All were very difficult to root. As soon as the leaves were developed, it became evident that they were *Eucharis*. As my soil mix for the *Amaryllis* had considerable lime in it, I thought best to transplant the *Eucharis* to a soil having more humus. One pot, however, looked so happy that I did not disturb it. I remembered the very good advice Mr. Houdyshel had given me, to the effect that if a plant seemed happy with the culture being given it, to leave it alone regardless of other methods advised by experts. This particular pot had originally four bulbs planted with part of the necks above soil, and in a 6" bulb *pan*! Now there are 6 blooming sized bulbs and 7 offsets, so crowded they are starting to push up the soil out of the pot, but these are the only *Eucharis* that have bloomed for me! While most writers agree that the bulbs should be crowded to bloom, everything I've read has indicated that the bulbs would not bloom if so near the surface, but mine certainly do. They apparently want much heat and humidity to bloom, for mine bud only during our hottest weather, on those few occasions when our nights are warm too, and in winter if the baby is sick so I keep the rooms hotter! Not at present having a greenhouse, but having to winter all my tender plants in the bedrooms, I am unable to give some of them the heat and humidity they like. But from this one crowded pot of *Eucharis* I have been getting bloom two or three times a year for the past three years.

When I transplanted the other *Eucharis* into a soil containing more leaf mold, they definitely didn't like it, and though they grew, they were not happy. Some of them I had to dispose of for I did not have room to winter all of them inside the small house. The rest I tried to winter outside. Unfortunately, the winter I chose was the coldest this area has had for some years, and all but one pot froze or at least rotted because of heavy rains and cold. One group in a gallon salad oil can was kept under the back porch against the side of the house where it got some warmth through the walls, the bulbs being planted some 4" deep. The plants in this can survived but the bulbs are not as happy as those in the 6" *pan*.

If *Eucharis* can be given sufficient warmth, they make wonderful pot plants, for the leaves are tropical looking and decorative even when not in bloom.

Haemanthus coccineus has been of easy culture here. I potted the large bulb I received in an 8" pot, and except for a little fertilizing, it gets no attention whatever. It grows in the winter when we get our rains, and is dormant all summer in the dry season. I should think it would naturalize here as well as the *Brunsvigia rosea* (Lamarck) Hann. (syn.—*Amaryllis belladonna* Ait.; non Linn.). My bulb of *Haemanthus coccineus* has produced two offsets, one at least of blooming size. While *H. coccineus* is an interesting and easy pot plant, it is not as decorative as some of the other *Haemanthus*.

H. albiflos should be as easy as *H. coccineus* and very interesting, but the narcissus fly got the small one I had. A *Haemanthus* I got under the name of *H. puniceus* seems very happy in its 6" pot but I have had it only a little while.

A *Haemanthus* that came to me via the West Indies, is the most decorative of any I have, with four to seven broad thin leaves spreading out from a 10" tall stalk which is heavily spotted with maroon dots. The green canopy lasts about ten months before the bulb is dormant for a month before flowering. These *Haemanthus* are summer flowering and nearly evergreen, seem to want some shade and moisture, and have been happy in pots even of small size.

I have some seven or eight different varieties of *Hymenocallis* which I have obtained from various sources but have not identified definitely, and most of them do well in pots varying from 4" to 8" depending upon size of the bulb. *Hymenocallis caribaea* is shown in Figure 207. Some of the *Hymenocallis* are swamp plants and of course, require much moisture when potted. Most of mine seem to require a long growing season and want to be kept evergreen. All bloom only during our warmest weather. All are very fragrant but what interests me most is how different the fragrance is in the various species, or varieties, which I have. I'd like to see these classified by fragrance. I have not tried digging these bulbs and keeping them dry like *Ismene*, but no doubt some species would thrive under that culture.

Ismene (Figure 208) are potted and forced into bloom by many people living in the colder climates. I have grown mine only in large boxes, such as an apple box, planting 6 or more in only part of the box (usually *Sprekelia* and other bulbs are also placed in the same box) and they have thrived and bloomed well. They are attacked by narcissus fly, however, and some have been lost to that pest. I've planted my large ismenes about 4" deep in the box, and upon digging find the large roots spreading out over the flat bottom. I have usually dug these in fall and stored them inside the house where the bulbs could be kept warm, for the boxes were usually wanted for winter growing bulbs. This is not the same as growing them continually in containers with no change of soil, but lack of space and pots has prevented me growing them any other way.

Everyone is familiar with forcing daffodils in pots, but for growing year after year, I've found they need more root room than can be furnished in a 6" pot. I've had some "CHINA LILIES" (*N. tazetta* var. *orientalis*), PAPER WHITES (*N. tazetta*) and *leucojums* planted 2" apart and 4" deep, with grape hyacinths (*Muscari*) as thick as they could be planted at the 2" level, in an apple box. Here they have thrived and flowered for four years, the soil and box replaced once during that time. They do not seem to mind how close together they are as long as there is plenty of soil and depth *under* them. In a deep straight sided container such as a crock or a fruit juice can, I see no reason why they can not be grown permanently in the container.

The snowdrops (*Galanthus*) will grow in the standard fruit lug very well. Mine have resented the deep shade I gave them but none the less have bloomed repeatedly.

Nerines are always classified as fine pot bulbs, but in common with many other people, I have had few blooms. The only sure bloomer is *N. massonorum*, which hasn't missed a single year blooming for me and multiplies rapidly, sets seed, and generally seems a very desirable plant. From two bulbs given to me a couple of years ago, I now have many, and last fall had 8 flower stalks in a 4" pot, and the pot does not seem crowded with plants yet. The flowers are so small that a great many are needed to even be noticed when outside, but a 4" pot in full bloom is small enough to make a good table centerpiece or other inside decoration.

As this is being written, *N. rosea-crispa* has decided to bloom, which makes the second nerine I've been able to flower. I've waited three years for this one to show its beauty.

N. Fothergillii major I have had even longer and I've had no bloom from it. *N. sarniensis* I received this last summer so cannot tell yet what it will do for me; and even *N. Bowdenii* and the little *N. filifolia* do not bloom. *N. massonorum* bloomed when there was only one bulb in the pot and has bloomed repeatedly ever since. Some of the others are in 2 or 5" pots, some crowded and root bound, others not, but still no flowers. However, this failure to get bloom may be due to wrong soil or insufficient moisture, or both, but I cannot call such shy bloomers good subjects to grow in pots, particularly if one wants flowers.

Sternbergia lutea makes a fine pot plant and can be left undisturbed for a number of years, if the pot is fertilized often. In fact, these bulbs resent disturbance and want to be out of the ground as little as possible, seldom blooming the first year after planting. But once established I find they grow readily and easily in the pots, are reliable bloomers and multiply well. If one likes one's table center piece growing instead of cut and dying flowers, these can make a very attractive pot at flowering time.

Tulbaghia violacea grows very well in pots. I planted about 10 seed in a 5" pot and the first plant bloomed 11 months after planting the seed, and by 13 months from planting, all had bloomed. They seem to need much moisture, however, and if kept watered bloom off and on throughout the year here. I have never objected to their strong garlic odor in the

garden, but do not like them inside the house, though some people may like them in any situation.

But *tulbaghia fragrans* has my hearty recommendations as one of the very finest year round pot plants obtainable. The leaves are broader and more strap-shaped, of a very restful shade of bluish green, and it flowers for me as often as *T. violacea*. I have heard reports that *T. frag-*



Fig. 208. *Hymenocallis calathina* growing in apple box in California. Photo by Edith B. Strout, California.

rans flowered only in the spring, or at best, only twice a year. If one considers only one individual plant, perhaps this is true, but the “mother” plant splits into two plants of equal size just after flowering, and each of these divisions will flower in anywhere from two to three months. For instance, the pot I now have contained one plant in 1946, bloomed in September of that year, and split into two plants. One of

these was in bud in January of 1947, but a hard freeze froze the bud and so damaged the plant that it died. The other division, which had not budded, survived; and bloomed in the spring of 1947, dividing also into two plants. One of these divisions bloomed in August, the other in September, of 1947 and the last division made in September is in bud now, November 12, 1947 as well as the other divisions made in September. Thus the plant not only divides rapidly, but also blooms several times a year. And best of all, the umbels last a surprisingly long time, giving out their hyacinth-like fragrance so sweetly, but not as strongly as true hyacinths, that it seems a shame to leave such fragrance outside—I want it near me all day. I have mine potted in a 8" pot—rather large for a house plant and it looked large for the one division I first planted in it, but considering how the plants divide, the pot will soon be full and will then make a larger showing.

T. fragrans needs *lots* of water. The first one I got, a seedling kindly given me by Mr. Perry Coppens, I thought so precious I coddled it and was determined not to lose it by over-watering (I had just lost several rare items through over-watering). The poor seedling tried its best but just wasn't making the grade. I decided it was dying, so I might try flooding it to see if that would suit it better. And to my utter surprise, it not only survived but grew rapidly to flowering size. Since then I have tried never to let the pots dry out. This last summer I have been too busy to care for the plants properly, so *T. fragrans* has dried out many times and seems to be standing it, but it certainly does better with ample moisture. Anything that grows so rapidly and profusely, of course, must be well-fertilized too.

Vallota purpurea has been one of my failures, though usually listed as a bulb easy to grow in pots. I have not had a flowering size bulb, but have had several offsets given me. One rotted, one became the victim of the narcissus fly grubs, and the third also appears to have fly grubs in it. But I shall keep on trying this one.

There are many species of *Zephyranthes* and *Habranthus*, and all will grow in pots or containers; some are very adaptable while others seem very fussy about what they want. *Habranthus texanus* was the first I ever tried, and this did much better in pots than in the heavy clay soil for I could water the pots more thoroughly to induce bloom. One winter Mr. Houdyshel sent me a bulb to see if it could be transplanted and shipped during its active growing season. I potted in a 4" pot and it not only grew but flowered well. For the past four years I've grown these, the larger *Habranthus Andersonii*, and *Zephyranthes grandiflora* (syn.—*carinata*) in a fruit lug and they have thrived and bloomed very well, besides self seeding.

Yes, even the *Z. grandiflora* have self-seeded; for among the various bulbs I have received under this name from different friends, I have found no difference that I could tell in the flowers, but some will seed while other clones appear not to. Though these may be different species and should be called by different names, the difference between them, if any, is so slight I call them all *Z. grandiflora*.

Habranthus robustus took me four years to bloom but the failure, I am now sure, was due to insufficient moisture. These grew and multiplied in the pots or cans, with either acid or neutral soil, but did not bloom until one time when I accidentally flooded the pot for some three days, and soon after a bloom appeared!

I have found in general that all the zephyranthes, cooperias, and some of the habranthus, need much more water than any other plants I have. For example, I had recently repotted some *Z. insularum*, and when we got an early fall rain which lasted for three days, I noticed the pot was full of water to the brim and I was greatly concerned for fear I had not provided sufficient drainage in the pot. For three days these were flooded like this, but when the rains let up, up popped fourteen bloom all at once from the bulbs in that 6" bulb pan! Many other bulbs would have rotted under similar conditions.

A little *Zephyranthes* sent me from Mexico and called just a "deep pink" has bloomed oftener for me than any other this past summer. I have three bulbs in a small No. 2 can and there were very few times this summer when there wasn't at least one flower in bloom in that can. This flower was really a very deep rose color, about 2" across, with petals some $\frac{3}{4}$ " wide, narrower and more rounded at tips than *Z. grandiflora*, with the base of the petals fading to white and then pale green, and with stigma much taller than the stamens. I hope I will be able to get this charming bulb identified.

Cooperias have done better for me in cans, whether planted one to a can or several, for the cans hold the moisture better and do not dry out as fast as pots. *Zephyranthes candida* also does very well in cans, though it multiplies so rapidly it should be separated every year or it will get too crowded. These usually bloom in September but once in a while, if given sufficient moisture, will bloom in spring.

Zephyranthes citrina is one of the *Zephyranthes* which likes a lot of depth for its roots, and will not do well for me in small or shallow cans. In free soil, I understand this bulb becomes a weed in many places, but I tried it for five years, trying both acid soil and lime soil, flooding and drying out, but no bloom until I planted it in a lime soil in a deep can so the roots could have more room, and then it bloomed.

Pyrolirion flava most definitely wants plenty of root room to be happy. The first few lots I had of these bulbs, planted in 6" pots, were complete failures with me, but now I get bloom from them. I plant them in at least a gallon can, or one even deeper, in a sandy soil which is only slightly on the acid side. For me they seem to need a lot of water when growing and blooming, but want to be absolutely dry in the winter season when they are dormant. This is the reverse of our rainy season here, so the bulbs must either be dug in the fall and kept bare-rooted and dry, or the whole pot or can put where it will receive no moisture during the winter. But the large deep yellow flowers, looking like two three-petaled cups nested together, are worth every effort to grow and I consider it the finest of any of this group I have flowered. A 8" or 10" pot would probably provide sufficient root depth for these, but I prefer the straight sided

gallon cans. It does not seem to matter how sparsely or how closely these are planted as long as there is plenty of depth under the bulbs, and I believe the depth under them is the most important factor. Sometimes I've planted the bulbs nearly touching each other, but have about $1\frac{1}{2}$ " of soil over them and at least 5 inches of soil under them.

A bicolor variety of *Zephyranthes macrosiphon* bloomed well for one season and then joined the growing list of departed rare bulbs. Another group received last summer through the kindness and courtesy of Mr. George Hamor, of Barahona, D. R. are growing well and I hope will bloom next season. These apparently need a lime soil, and seem happy in a 6" pot or can of comparable size.

Another lime lover is *Zephyranthes bifolia*, which unfortunately I have been unable to flower. Mr. Hamor kindly sent me some seeds in 1944 which germinated well. Having several pots of them, I gave to various friends, and transplanted a few for myself into new pots when the tiny seedlings appeared crowded. I lost all of these seedlings except one pot I did not disturb. This one 4" pot has stayed outside summer and winter, and I have kept the seedlings evergreen. When the pot was accidentally broken last year I transplanted, and found the seedlings were between $\frac{1}{2}$ " and $\frac{3}{4}$ " in diameter. One lot of flowering sized bulbs Mr. Hamor sent me fell victim to the narcissus fly; a second shipment received this last summer has grown but does not seem happy. These last bulbs were budded upon arrival, but in spite of all the care I could give them, the buds did not develop. But I think the poor showing has been due to my handling rather than any dislike for the pots, and more seasons will be needed to find their preferences.

A *Zephyranthes* collected in the Philippines which came my way appeared to be very similar to *Z. insularum* but set seeds here while *insularum* does not seed for me. This one and one just recently received from Okinawa I have had too short a time to report on thoroughly.

A *Habranthus* species and *Amaryllis pratensis* were received just last summer from New Zealand and though they started to grow in summer, and the *Habranthus* species has multiplied, neither has flowered and I do not know yet what they will do or how they will like the pots.

Habranthus brachyandrus, sometimes recommended for pot culture, has been a complete failure for me. I have had this in a 4" pot for some three or four years, and though there has been some increase, and the bulb appears thrifty, yet I have never had a bloom. Lack of space has prevented me trying it in a larger container, but I strongly suspect it is one of those bulbs wanting root room and therefore a deeper container.

This brings me to that group of bulbs which have usually been considered as unsuitable for pot culture.

Amaryllis advena leads this list, and is, incidentally, one of my favorites. When I tried growing this in a 6" pot, it grew well but did not flower. A shortage of pots in this district during the war, forced me to put all the hardy (for this climate) bulbs in boxes to be grown outside. *Amaryllis advena* was one of these, going into half an orange crate. Here it has thrived and bloomed ever since, planted about 3" deep, but



Crinum Moorei c. Frank Leach, with two flower scapes, and growing in a pail. Photo by Edith B. Strout.

with plenty of soil under it. The box is about 10" in all dimensions, and contained in this box are about 12 bulbs, all from one deep oxblood red and one "pink" *A. advena* mother bulbs, about 30 seedlings which should be large enough to flower next year; 2 dozen BRODIAEA LILIES (seed planted in box and now flowering size). 6 *Lycoris radiata*, and 2 *Leucocoryne odorata*. In spring the *brodiaeas* and *Leucocoryne odorata* are in bloom, and in fall the *Lycoris radiata* and *Amaryllis advena* put on their show, fortunately at different times so the colors do not clash. The box is now quite full, but all the bulbs are thrifty and very happy for it is the *depth* of the soil in the box that seems to count, and not crowding, for the two mother bulbs of *A. advena* flowered just as well when they were the only ones in the box.

From this I am wondering why some of the gardeners in more northern climates do not try the *Amaryllis advena* in deep flower boxes. I should think the bulbs could be planted in early August in the boxes, either alone or with other bulbs or annuals. Since they will stand considerable cold, growing them right against the house would afford some protection and they would get some warmth from the walls. In summer, they would have to be taken up or left dry, for my experience has been that they are very fussy about wanting to be kept bone dry in summer. They need full sun and bloom in August or September. Their very graceful flowers are well worth the efforts to grow and their cut blooms would add much to flower arrangements.

Brunsvigia rosea (Lamarck) Hann., called CAPE BELLADONNA or NAKED LILIES out here, has been tried by Eastern gardeners many times, but usually without success. Out here they are normally planted in the garden and forgotten until their spicy pink bells make a real showing in the fall. Since 1943 I have grown all of mine in containers and have had bloom every year. The variety usually called *Brunsvigia rosea* var. *major* is in a nail keg, five nice flowering sized bulbs (and these bulbs are normally very large). This bulb (one to start with, now five) has never missed a single season for bloom, and is quite happy in the container. The soil has never been changed, and I must admit, I've forgotten to fertilize. A variety I have which is a brilliant deep rose with a white throat, and which turns to a solid magenta as it ages, has also been happy in a nail keg, as well as the white *Brunsvigia rosea* var. *multiflora alba* (Plate 209). *Brunsvigia rosea* var. *minor* (Plate 210) is planted in a tin pail with soil only 7½" deep, and another bicolor having a very deep rose edge and white throat does well in a can 9½" deep. These did not bloom for a couple years after being planted in the smaller cans, but have bloomed the past two years. Those in the nail kegs always bloom, if given sufficient sun. With all of these containers the sides are either straight or else, as with the nail kegs, taper very little, so there is plenty of root *below* the bulb, and this is what I think is most important with this class of bulbs. I see no reason why these varieties of *Brunsvigia rosea* could not be grown in a 10" or 12" pot, for this would have more soil than the pails in which I have the *var. minor* planted. If given their other cultural requirements, of wet winters when they do their growing,

and absolutely dry in summer yet having the hot sun to bake them out, they should do well, particularly in the arid sections of the mid-west. And they are definitely worth trying to grow, with their fine pink or rose color and especially their spicy fragrance. Even the lovely white ones are richly fragrant.



Fig. 209. *Brunsvigia rosea* var. *multiflora alba* growing in a nail pail in California. Photo by Edith B. Strout, California.

Very similar in culture to the varieties of *Brunsvigia rosea* is *Lycoris radiata*, which grows so well out of doors in the southern states. This bulb makes its growth during the cool winter months, is dormant in the dry summers, and flowers before the leaves appear in the fall. Usually they will flower the first year in pots, but not in succeeding years. The

first one I tried in a 6" bulb pan, and when it was not thriving I knocked it out, to find the roots had enlarged to about $\frac{3}{4}$ " in diameter, were clear, transparent and looked more like tubers than roots. I have never seen the roots of this bulb looking this way when given sufficient root room. I suppose they are trying to store up food and moisture. After planting in one of the half orange crates, where it had more depth, it has thrived along with the *Amaryllis advena*. The box is very crowded with other bulbs but it is the depth of the soil under the bulb which seems to count most.

Lycoris incarnata was planted in a small 4" pot and the first season fell victim to the narcissus fly, so I do not know how it would otherwise behave. *Lycoris squamigera*, planted in a pail, did not thrive the first year and then it too, fell victim to "the fly." Circumstances have prevented me trying these again.

Lycoris aurea grows well in the half orange crates. I believe this bulb would do well in smaller pots, but I have not tried it in the smaller containers. The fly seems to like these very well too, and I've lost several, but others seem happy in the boxes. These should have some moisture during the summer and will suffer if left completely dry like *L. radiata*. They also seem to want a sandier soil. Their beautiful yellow umbels in the fall are well worth striving for and I rate it among my choicest bulbs.

Many people grow crinums in pots or containers, but being large bulbs they seem to need unusually large pots. The most successful one I have grown is *Crinum Moorei* c. FRANK LEACH (Plate 329)—the large plant occasionally seen around here. This I have planted in a 10" diameter pail, 10 quart capacity, which seems very inadequate when the three foot high plant and a couple of four foot flower stalks are in bloom! This bulb has been here for four years, has made nine or ten offsets, about three of which have been removed. Generally, with me at least, all the crinums resent moving and I've never had one bloom the first year after transplanting or after getting it though I know several people who dig the crinums each fall and replant in spring and get flowers regularly. *Crinum Moorei* c. FRANK LEACH and another variety of *Crinum Moorei* that I raised from a tiny offset, are the only ones I've flowered. The hybrid crinums, CECIL HOUDYSHEL and ELLEN BOSANQUET, and *C. bulbispermum* were all received as offsets and some are now large enough to bloom. *C. Kirkii* and two other unknown ones were flowering size bulbs but did not bloom the first season after planting, and I will have to wait till next year to see what they do.

Calostemma purpureum is a very lovely Australian amaryllid that I hope will be planted more generally. To me, it looks like a miniature deep rosy purple daffodil with the perianth not quite opened, but the yellow lip of the cup trying its best to get your attention. Unfortunately I've only gotten it to bloom twice, but this was due to adverse conditions. The first season it bloomed, "the fly" got into it, so I took drastic measures. Although warned that paradichlorobenzene crystals would kill bulbs if placed near them when the soil was damp, I put the crystals directly on the cut portion of the flower stem, in the heart of the leaves and

all around the bulb, for I did so want to save the bulb. I was successful—all the fly grubs were killed, the bulbs lived, but I lost the flowers for a couple of years. Now the plant is in bloom again, and with all appearances of another attack of fly grubs! So I suspect it is quite attractive to the fly and precautions should be taken to safeguard it against attack. I have two bulbs and two offsets growing in a 5" pot. They have been in the pot, with no change of soil, for four years. For me, this bulb seems to prefer to be kept evergreen but I'm not sure that others would find this desirable.



Fig. 210. *Brunsvigia rosea* var. *minor* growing in a small pail in California. Photo by Edith B. Strout.

Incidentally, from my own sad experience, paradichlorobenzene crystals is the only thing that I know of that will kill the narcissus fly grubs and save the bulbs, if caught in time. I have put the crystals directly in the leaf axils of *Amaryllis* and other plants, and though it will, of course, burn the leaves it touches so severely that they will die, the bulbs survive and soon regain their original vigor with the exception of *Amaryllis belladonna* Linn. (syn.—*Hippeastrum equestre*) and some of

its hybrids that have a lot of *A. belladonna* characteristics. The crystals seem to kill these bulbs, for they never recover. On the other hand, the crystals were used on two of the *Haemanthus* from Saba Island, both badly infested with grubs. In one, the grubs were all around the base of the bulb and were eating in from the outside—in the other the center of the bulb had been eaten quite badly. Crystals were put directly in the center cavity of this one, and around the other bulb, and both bulbs flowered the following year! When the lesser narcissus fly is in the neighborhood, constant vigilance is needed for just one bulb overlooked can produce a lot of flies to lay more eggs in my own yard, and all the flies from the neighbors yards must be fought. Since the narcissus fly seems to be well established in this neighborhood, I have a constant fight on my hands and have lost many prize bulbs to it in spite of my efforts.

Milla biflora and *Bessera elegans* were grown in the shallow fruit lugs, and bloomed well the first year I had them, but have not bloomed since. This may be some cultural fault of mine, however, and I'd want further trials before saying they could, or could not, be grown will in boxes or pots.

From reading various accounts, I always thought *Alstromeria* was too tall a plant to grow in pots, and I never tried it, until some seedlings of a purple-rose variety came my way in a pot of *Amaryllis*. I transplanted the seedlings to an apple box, among the tulips and hyacinths, and let it grow. For several years, though the plant had grown to a nice size, I had no flowers, for I had been watering all summer. But this year I let it stay dry during the summer but watered in fall, and had a very nice group of flower stems. Recently in moving the plants to a new home we are building, I found a large clump of nice tubers, with the roots reaching all the way to the bottom of the apple box. Others have no doubt had much more experience with these plants in pots than I, but I see no reason why they could not be grown in containers.

Naturally, I've had some complete failures. Among these has been *Sprekelia formossima*. I've tried the usual type, as well as *var. superba*. I've tried them evergreen, dried off in winter, in pots, and in boxes, and I've never gotten a flower in six years! The same is true of *Childanthus fragrans*. For the past two years I've had these planted in an apple box with the ismenes, but still never a bloom. Some I've left potted so the roots would not dry, some I've given some water in winter, and have generally tried them every way I could think of, but without results.

Stenomesson variegata I believe, has not bloomed for me. This bulb seemed to want to be evergreen, growing well in winter and even making offsets, but has never bloomed. Now, in an effort to get bloom, I am keeping it dry all winter to see what will happen and if it will bloom for me next spring. It is husky, has produced a number of offsets, but just does not bloom. The reason is probably in my culture, not in its resentment of the pot, but I will have to wait till I've gained more knowledge of it to decide. Some seedling *Stenomesson Pearcei* seem to be growing slowly, but growing none the less, but they are still too small to bloom.

The *Pancratium maritimum* I once had was never happy in the pot and departed this life before further trial could be made. *Polianthes*

tuberosa has not bloomed for me, though this last year in a fruit lug it made good growth. I think this is due to insufficient water during the summers, as well as other soil requirements not fulfilled to their liking. *Ixiolirion montanum* bloomed well the first year in a fruit lug, and bloomed the second year, but since then I have not seen it. This is a very worthy garden subject, in my opinion, and I want to try it again. I believe it resented more our warm winters which forced it into early growth, rather than the boxes, but further study will have to be made on that point.

One of my most amusing experiences with growing plants was furnished by some bulblets of *Furcraea gigantea* (placed in the *Agavaceae* by Hutchinson). A friend of mine had secured some of these and they had gotten mixed up with her bulbs of *Leucojum*, and she sent me three under the name of *Leucojum*. I was not very familiar with bulbs at that time and so planted them, but as soon as they started to grow, I knew they weren't leucojums. I had two in a pound coffee can, and one in another coffee can. They grew and grew. I discovered that they were very tender for a light freeze froze the larger bulb, but it made offsets before passing on. After my "leucojums" were identified, I knew I could not grow a plant with 8 foot leaves and a 25 foot flower stalk in a coffee can, so I passed on this plant to friends who could give it more room as well as a frost free location. It is one plant I definitely would not recommend growing in pots, but undoubtedly it *could* be done, if the container were *large* enough!

SOUTH AFRICAN AMARYLLIDS—COOMBS

[Continued from page 112.]

should take place just when the bulbs start to grow their roots after the drying time. The only treatment usually necessary is to dig out the top soil only, work off the offsets and fill the space with rich soil. The offsets may be planted about 4 to a 3 inch pot or singly in a 2 or 2½ inch pot and transferred to a larger pot when necessary. Water carefully after repotting. Do not overwater.

Seeds germinate quickly and should be planted as soon as ripe in shallow pans in good sandy soil. Do not cover seeds too deeply. Leave in pans till following autumn, then pot into small pots. The smaller seedlings should be saved carefully, if they are hybrids. Mealy bugs are the pest which like these bulbs best and should be watched out for.

Mr. Weston wrote of the ways of his nerines, some of which bloomed several times a year. *N. Bowdeni* bloomed in October, April, and ahead of normal times in one year and *N. filifolia (rosea-crispa)* blooming five times in a year. These bulbs ignored rules and regulations.

[The second installment of this article will appear in a later edition of HERBERTIA.]

COPIES OF VOLUME 1 (1934) WANTED

WANTED—TWO COPIES OF VOLUME 1. The Year Book of the AMERICAN AMARYLLIS SOCIETY (HERBERTIA), Volume 1 (1934) was dedicated to the late Henry H. Nehrling, the distinguished plantsman. Single copies of this issue are no longer available. We have recently received a request from Mr. Arno H. Nehrling, a son of the distinguished plantsman, and Director of Publications Massachusetts Horticultural Society, for two copies of Volume 1 (1934). It would be very much appreciated should those who can spare their copies of this volume communicate with the Asst.-Secy., Mr. E. Frederick Smith, Box 2398, Stanford, Calif., who will keep a record for such available copies. The condition of the copy and price wanted should also be indicated. In this way Mr. Arno Nehrling and any others wanting this volume can be supplied.

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When describing daylily clones, all breeders and growers are requested to use the Official Data Card for Hemerocallis, devised by the eminent artist and horticulturist, J. Marion Shull, and fully described in HERBERTIA, Vol. 7, 1940 and Vol. 14, 1947. These cards should not only be used in describing new clones but also for the description of all older clones grown in the various climatic regions.

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Volume 15 (1948). 2ND SOUTH AFRICAN EDITION. Dedicated to Dr. R. A. Dyer. This volume contains an autobiography of Dr. Dyer and two amaryllid articles by him, and other articles on South African amaryllids. There are also important articles on *Hemerocallis*, *Amaryllis*, *Crinum*, *Narcissus*, BRODIAEA LILIES, *Alstroemerias* and other amaryllids by various authors. Forty-one illustrations—177 pages.

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AMARYLLIDACEAE: TRIBE AMARYLLEAE, by Hamilton P. Traub and Harold N. Moldenke. The American Plant Life Society, Box 2398, Stanford, Calif. 1949. Manila covers; 18 illustrations; 194 pages. \$4.00.

This is a systematic treatment of one of the main tribes of the *Amaryllis* Family (Amaryllidaceae), including the seven genera *Lepidopharynx*, *Worsleya*, *Amaryllis* Linn., *Placea*, *Griffinia*, *Ungernia* and *Lycoris*. Detailed descriptions of the species are included. For a more detailed notice on this book the reader is referred to the abstract published in this issue of HERBERTIA.

DESCRIPTIVE CATALOG OF HEMEROCALLIS CLONES, 1892—1948, by J. B. S. Norton, M. Frederick Stuntz, and W. R. Ballard. First Edition. The American Plant Life Society, Box 2398, Stanford, Calif., 1949. Manila covers; 1 illustration; 100 pages. \$1.50.

This is sponsored jointly by the AMERICAN PLANT LIFE SOCIETY and the HEMEROCALLIS SOCIETY and consists of an introductory section concerned with the naming and description of *Hemerocallis* clones, and an alphabetical list of *Hemerocallis* clones with very brief descriptions as far as known.

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